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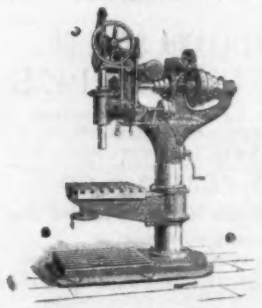

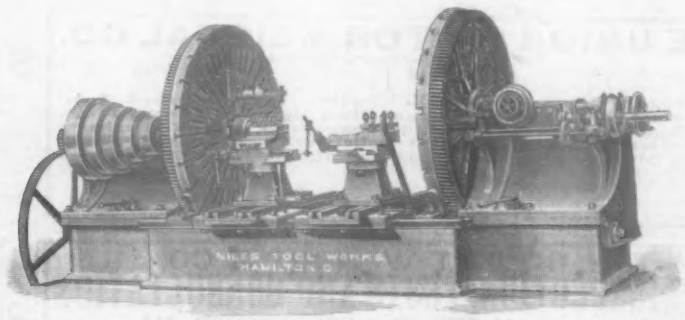

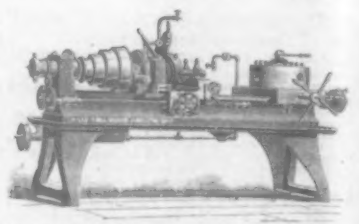

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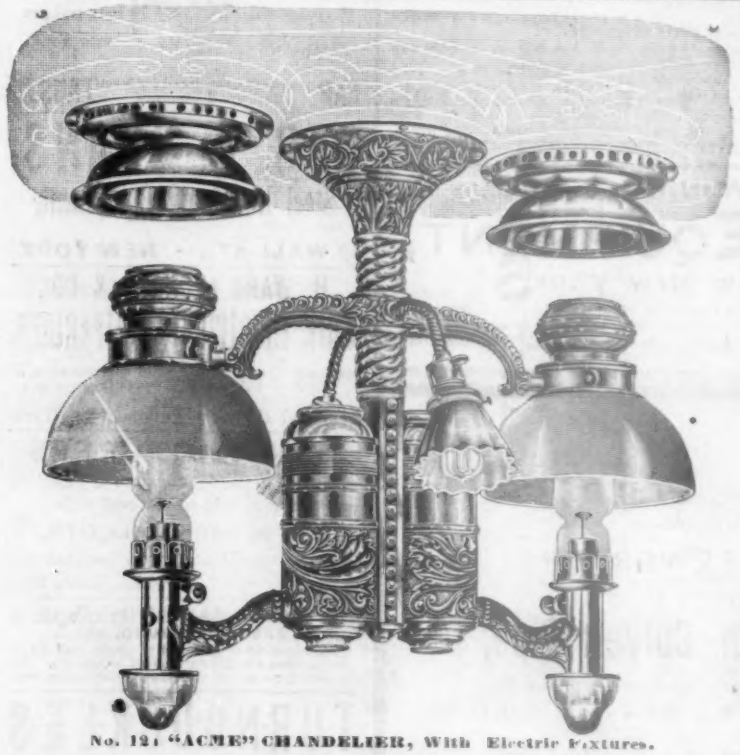

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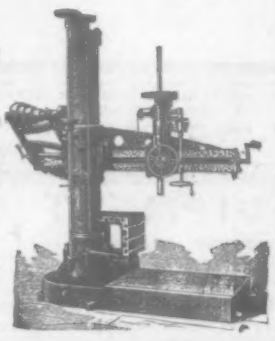

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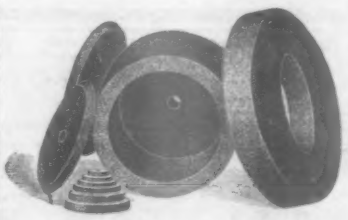

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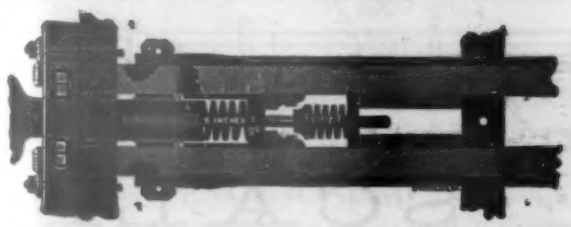

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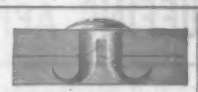

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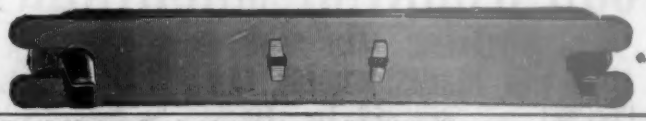

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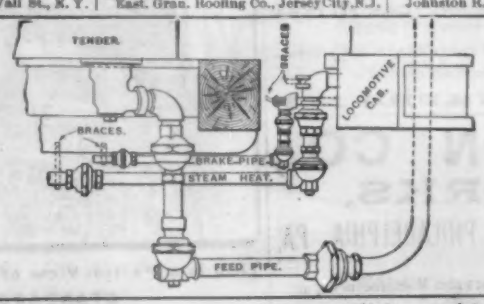

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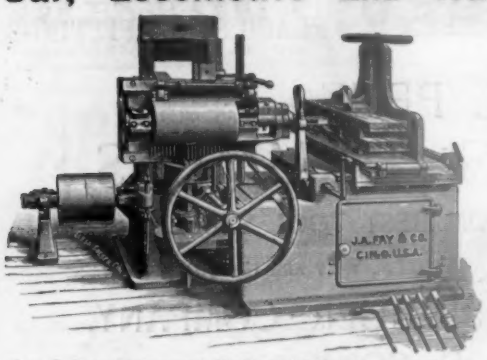

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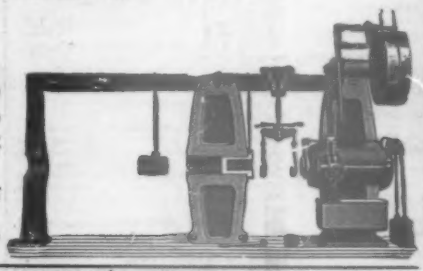

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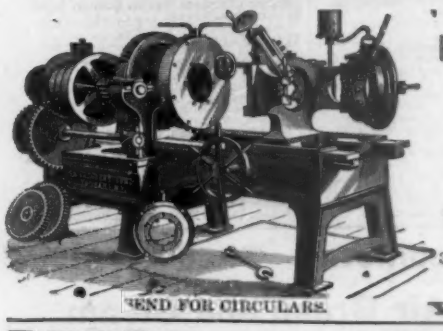

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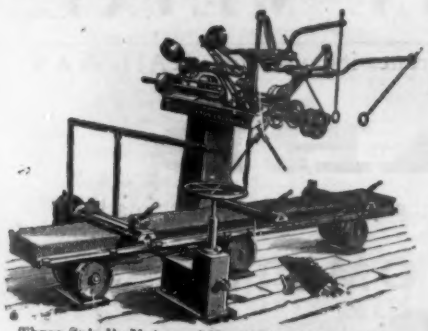

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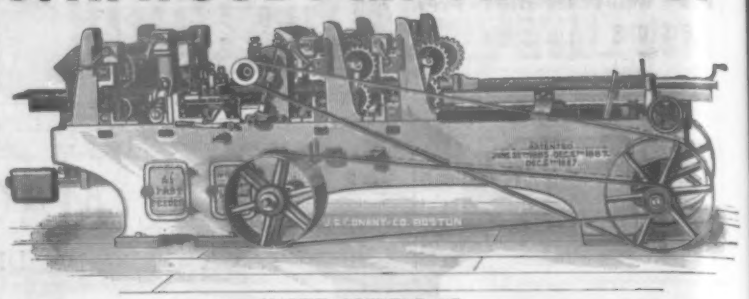

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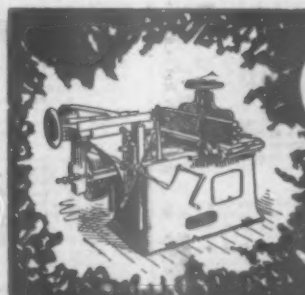

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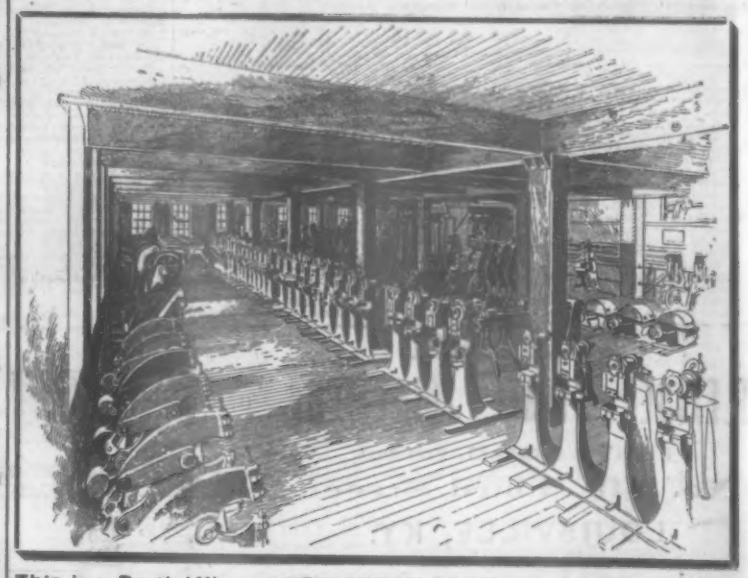

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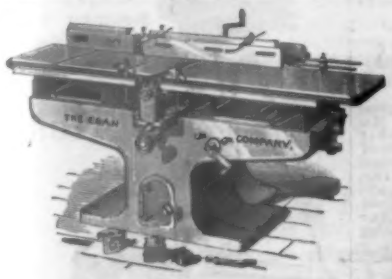

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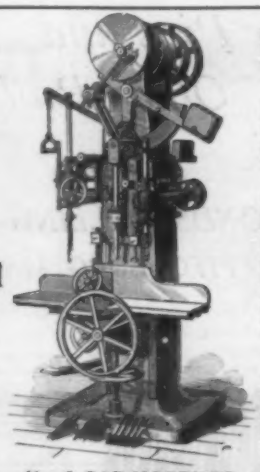

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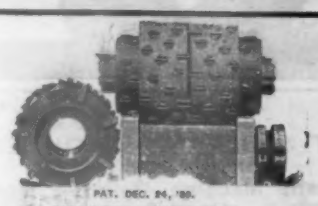

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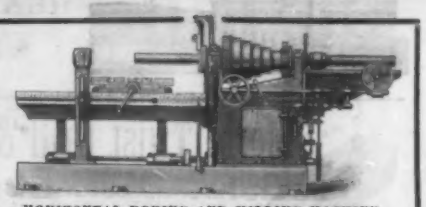

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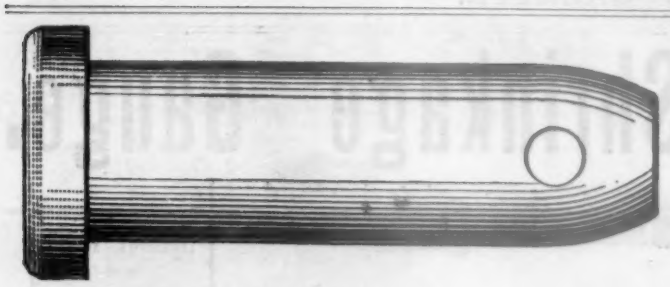

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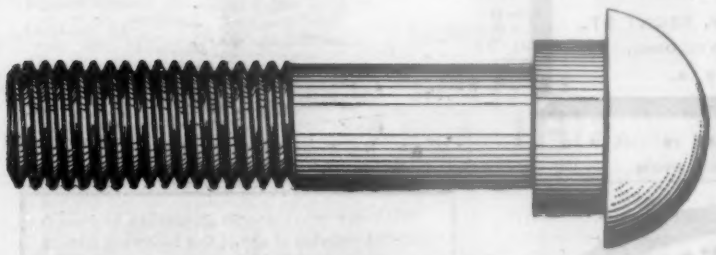

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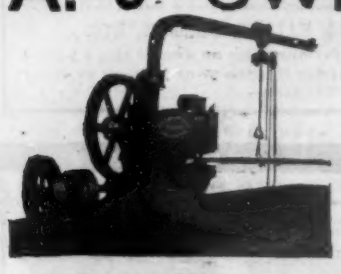

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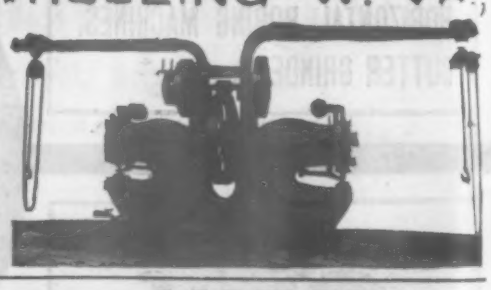

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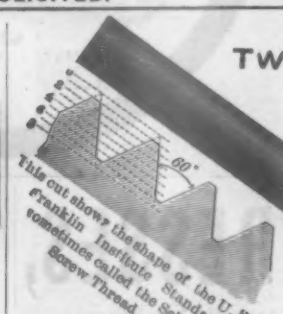
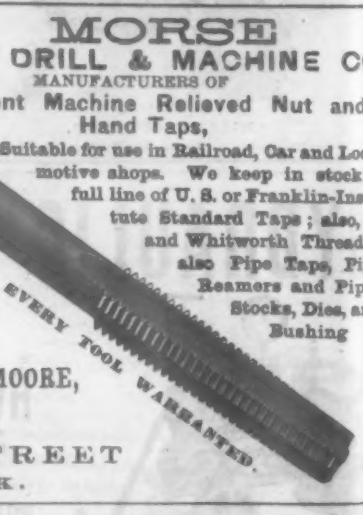


This cut shows the shape of the U. S. Franklin Institute Standard sometimes called the Sellers Screw Thread.



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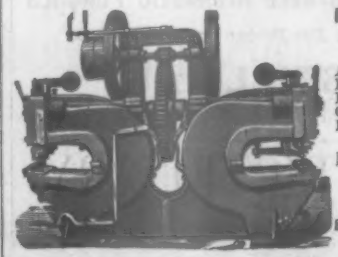

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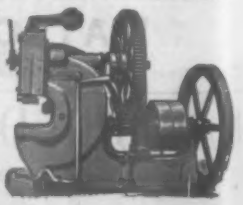

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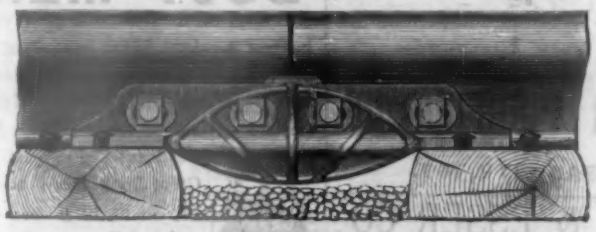

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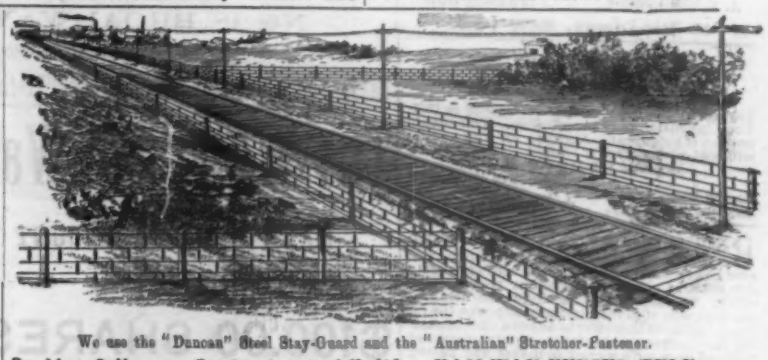

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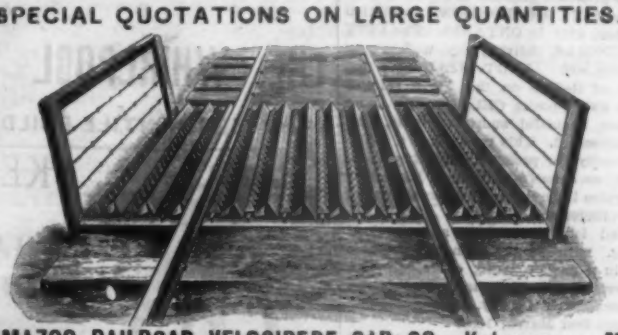

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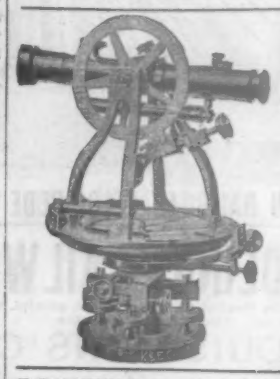

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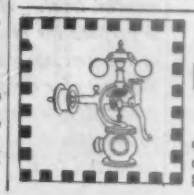

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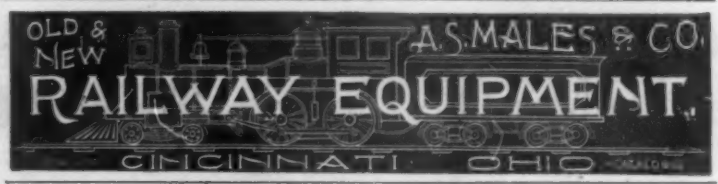

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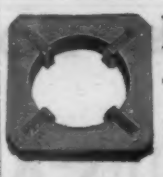

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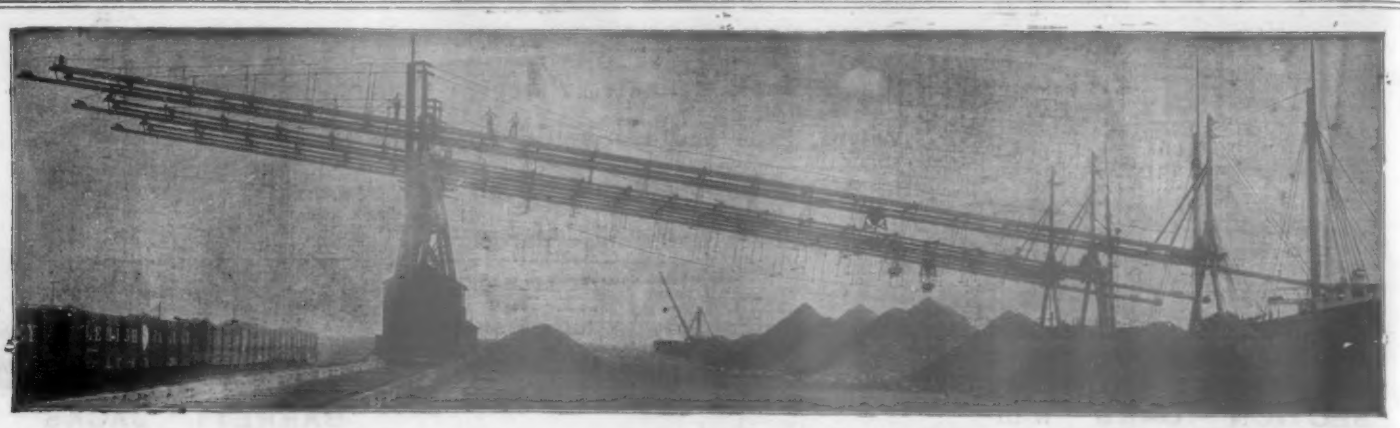

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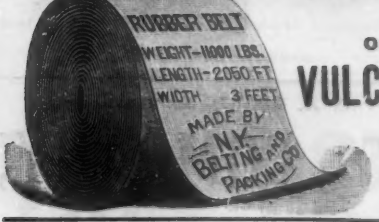

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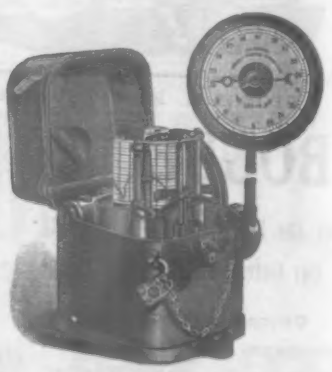

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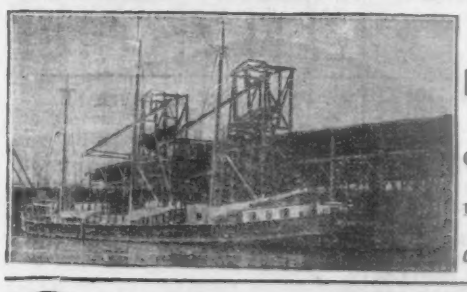

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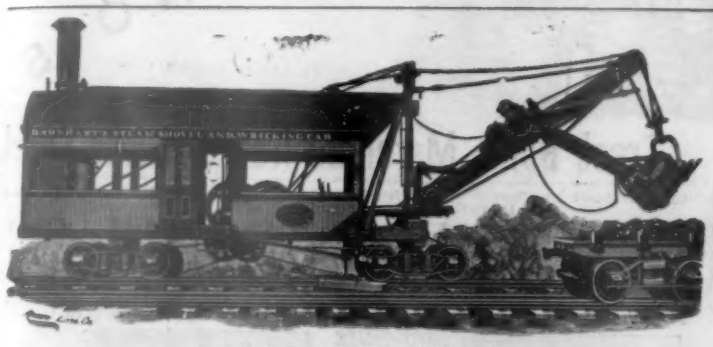

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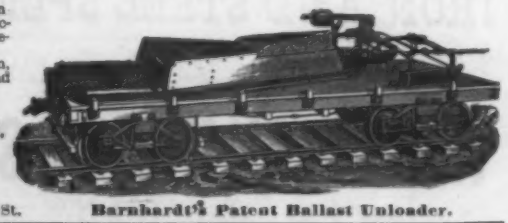

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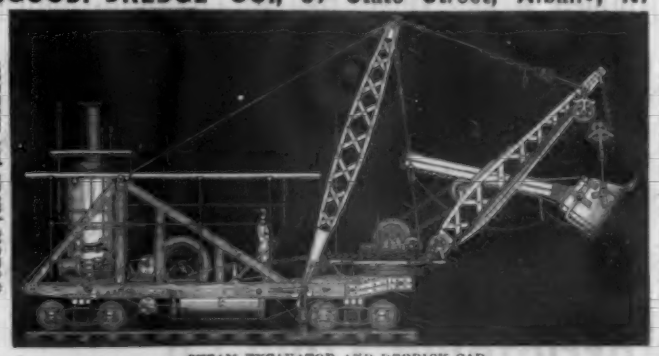

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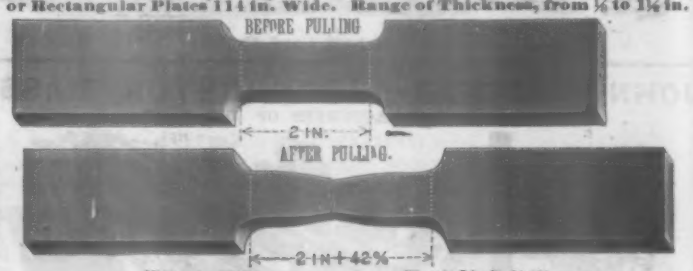

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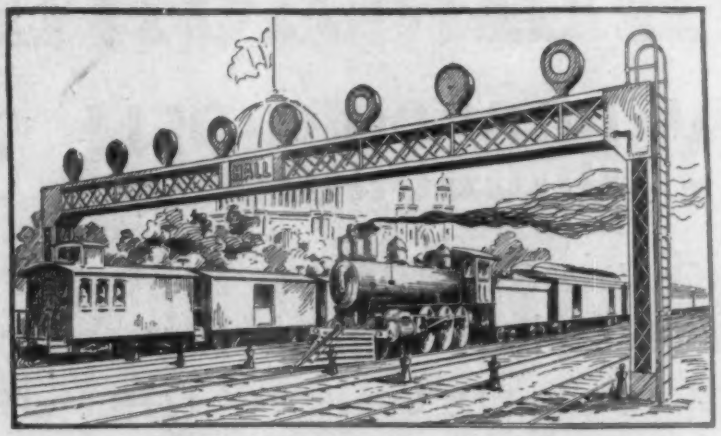

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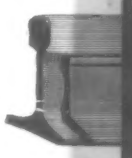

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THE

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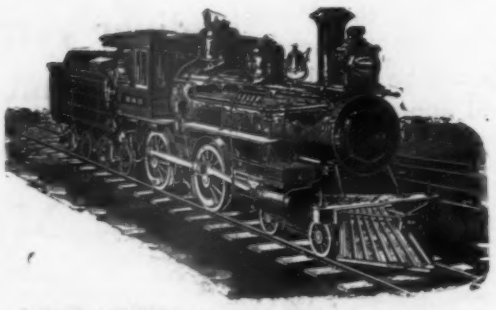

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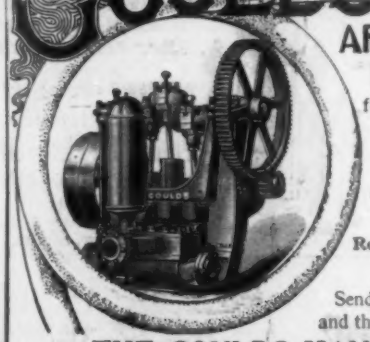

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RAILROAD GAZETTE

FRIDAY, NOV. 18, 1892.

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Contributions.

Electric vs. Steam Locomotives.

Chicago & Northwestern Railway Co.,
CHICAGO, Nov. 12, 1892.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of Nov. 4, page 822, I notice an article taken from the *Electrical World* of Oct. 22, in regard to some tests made by me on steam locomotives. In justice to myself I would like to say that the *Electrical World* published but three of five cards sent them, and of the three published there was but one that could be taken as good practice as found on stationary work, and even on this card they printed the M. E. pressures that belonged to another card.

By referring to the print inclosed you will, perhaps, see what I meant in making the statement that these cards were "as good, if not better, than those taken from nine-tenths of our single expansion electric light engines." I should have excepted, of course, all engines of the releasing valve gear type, as I had in mind only the standard high speed single valve engine. I do not consider that the *Electrical World* did me justice in the article published, and it leaves me in a very unenviable position. I do think that they take a very prejudiced view in regard to the question of steam vs. electricity for large power units. CARL K. MACFADDEN,
Electric Light Insp. C. & N. W. Ry. Co.

[The blue print accompanying Mr. MacFadden's letter shows five pairs of indicator cards taken with a Thompson indicator from a C. & N. W. locomotive having 18 x 24 cylinders and 62 in. driving wheels. Three of these cards were taken at speeds of 26, 36 and 42 miles per hour, and with cut-off at 9, 8 and 7 in. respectively, and show a very good steam distribution. The mean effective pressure for the three cards is given as 55.5, 60 and 45.5 lbs.—EDITOR RAILROAD GAZETTE.]

New York Rapid Transit.

The Board of Rapid Transit Commissioners of the city of New York, has completed the plans and specifications for the Rapid Transit Railroad to be built from the Battery to the northern limits of the city and the franchise is advertised to be sold at public auction Dec. 29. A printed pamphlet is issued containing very full details of the necessary organization of the company and of the specifications, and a number of sets of blue prints have been prepared which are open for inspection at the office of the Commissioners. The franchise will be sold for 999 years, and will carry the privilege of constructing, maintaining and operating the railroad.

The route begins in Whitehall street, the lower end being a loop, the tracks converging to be parallel under Broadway between Bowling Green and Morris street. Thence the line passes under Broadway and Union Square to Fifty-ninth street, thence under the Boulevard to 121st street; thence by viaducts, tunnels and subways to the northern limit of the city. There will be a loop from Broadway under Mail street, the City Hall Park and Chambers street, there connecting again with the Broadway line. A branch line will diverge from the Broadway line at Fourteenth street, run under Union Square to Fourth avenue, under Fourth avenue and Park avenue to a point north of Fortieth street, thence by various curves and tangents to a point north of the north line of Forty-third street, and 100 ft. east of the centre line of Madison avenue.

The successful bidder must pay down 10 per cent. of the amount bid, and the remaining 90 per cent. within 30 days after written notice has been served that the bid has been accepted. He must give security of $1,000,000 for full compliance with the term of sale, and security to the extent of $2,000,000 for the payment of damages to the city or individuals. He must also pay within 30 days the sum of $89,247, with interest from Nov. 12, 1892, being the expenses incurred by the Board of Rapid Transit Commissioners. He must pay within 30 days after the acceptance of the bid a reasonable compensation for the services of the Rapid Transit Commissioners, the amount to be determined by the general term of the Supreme Court; and finally he must pay the expenses of the Commissioners from Nov. 12 to the time of sale.

Within two months after the sale of the franchise, a corporation must be organized to take over the rights secured under the franchise. This corporation must have a capital stock of $50,000,000, and 5 per cent in cash must be paid on subscription to the stock. A maximum bonded indebtedness of $50,000,000 is authorized. The maximum rate of fare is five cents and the maximum freight rates are 20 cents a ton-mile for carload lots, and five cents per 100 lbs. for less than carload lots; the minimum for any package being 25 cents.

The work of construction shall be under the supervision of the Board of Rapid Transit Commissioners and subject to the approval of its engineers; the salaries of these engineers to be fixed by the Board and paid by the coporation owning the franchise. Construction must begin within four months after the bid is accepted and must be completed within five years from the commencement. From City Hall to Fourteenth street construction must be finished within two years. That portion south of City Hall and those between Fourteenth and Fifty-ninth streets on the west side, and between Fourteenth and Forty-third streets on the east side, must be finished within three years. The portion above Fifty-ninth street to the Harlem River must be finished within four years, and the rest within five years. The Board, however, reserves the right to extend the times for commencement and completion of the work. It also reserves the right to reject all bids and readvertise the franchise for sale.

The provisions for the organization of the corporation to build and operate the road are very thorough. The articles of association must be signed by not less than 25 persons and approved by the Board. The Board will then open books for subscription to the capital stock and give public notice of the same, and when the full amount shall have been subscribed for by not less than 50 persons, the Board shall call a meeting of the subscribers for organization, the buyers of the franchise to have the preference in the allotment of stock. At this meeting thirteen directors shall be elected, each of whom must hold in his own right at lest 100 shares of the capital stock, and the Board will appoint the inspectors of the first election. These directors shall hold office for one year. At this meeting by-laws must be adopted subject to the approval of the Board.

The Board may at any time authorize alteration of, or additions to, the detailed plans and specifications, provided these changes do not alter the route of the railroad and are not inconsistent with the general plan of construction; and provided that the modifications are first approved by a vote of two-thirds of the directors of the corporation, present and voting, at a special meeting called by written notice.

Other sections of the terms of sale provide for the individual liability of stockholders and for the protection of contractors and employés.

The corporation may increase or reduce its capital stock on the approval of the Board of Commissioners and by the action of two-thirds of all the stockholders of the corporation.

The railroad may cross, intersect, or join any other railroad, at any point on its route and upon the grounds of such other railroads; and if the two corporations cannot agree upon compensation, this should be determined by commissioners properly appointed, the board of Rapid Transit Commissioners determining the point and manner of crossing, and connection.

Electricity, or some other power not requiring combustion within the tunnel, must be used as the motive power, and this motive power and the rate of speed must be approved by the Board of Rapid Transit Commissioners. Existing railroads are protected by the terms of the sale, as are the streets, public parks and squares. The corporation will be required to carry the United States mail for proper compensation.

Specifications.—The loop under Battery Park, etc., will be double track, the two tracks on one level. Thence to Vesey street there will be three tracks on the same level; thence to 190th street on the west side line there will be four tracks; thence to the city limits two. The east side line from Fourteenth street to its terminus will have four tracks. All of these are to be parallel and on one level. On the Broadway and Boulevard line, 35 stations are specified and on the other line three.

Suitable cross covers must be provided between the tracks, together with footways for the whole length of the lines, and in the depressed and tunnel portions there must be refuge niches in the walls. These details, like others, must be submitted to the approval of the Commission.

The specifications and the drawings which illustrate them are only general and typical. It has been the purpose of the Board and its engineers to leave great discretion to the constructing company as to the manner of doing the work, merely laying down general plans and furnishing general designs; but every step in the construction and every detail of building, equipment and method of operation must be subject to the approval of the Board of Commissioners.

The manner of construction from South Ferry along the line of Broadway to about Thirty-fourth street, and in Park avenue, above Thirty-fourth street, is to be by underground tunneling without disturbing the surface of the street. It is provided, however, that in the excavations below Beaver street, and in the neighborhood of Canal street, and at such *other special points* as the Commission may determine, excavation may be made from the street surface, and all excavations in Fourth avenue, below Thirty-fourth street, and in other streets and avenues above Thirty-fourth street, may be made in the same manner.

The typical shallow tunnel is 11 ft. 6 in. deep; for two tracks it is 24 ft. wide, for three tracks 35, and for four tracks 44. The side walls are to be of stone masonry faced with brick, the columns, girders and beams of steel, and the roof arches of brick. These arches have their axes transversely of the tunnel and are supported by steel eye-beams. For the part below Bowling Green hydraulic concrete must be used under the roadbed, extending from side wall to side wall. The open subways are to have substantial side walls of stone masonry. The viaducts in general are to be entirely of steel, although masonry viaducts are called for, for some short portions.

The company must submit working drawings for the approval of the Commission, but with that approval and as far as is consistent with the requirements of law, the method of construction will be such as the company wishes. Proper protection to buildings must be provided, including, if necessary, new foundations, and any arrangements for the protection of underground pipes or for changes in them, must be subject to the supervision of Commission of Public Works. All supervision by this Commission as well as by the Rapid Transit Commissioners is to be paid for by the constructing company. The method of disposing of excavated material as well as the location of shafts and other means of access to the work, must be submitted to the Commission for approval.

In computations to determine the strength of the structure, the weight estimated on must include the soil and pavement, the pipes and other structures beneath the surface or on it, the weight of the roof and a live load of 1,500 lbs. per sq. ft. of surface, and the structure must be in design and proportion such as would be suitable for a first-class, standard gauge, passenger railroad. The rail must weigh not less than 75 lbs. a yard, and the trains must be protected by proper block and other signals.

Drainage must be provided for by suitable drains leading to sumps, and there pumping plants must be constructed of sufficient capacity to deliver the drainage into the sewers.

Motors must be electric or some other not requiring combustion in the tunnel. They must be of such power as to readily start an 8-car train, each empty car weighing not less than 30,000 lbs., on a grade of 1½ per cent., and to maintain a speed with the same train of not less than 40 miles an hour on a level. Should each car have its own motor it must be sufficient to meet these requirements, for each car. The methods of lighting and heating the cars are also subject to the approval of the Commissioners as are all the details of platforms, stations, approaches and ventilation.

Wherever the vertical distance between the grade of the street and the station platforms exceed 20 ft. passenger elevators must be provided.

Finally, a railroad must be built of the best possible construction, and having the highest efficiency; and although the Commission will supervise the work, nevertheless, such supervision does not relieve the constructing company of any liability.

The terms of sale and the specifications are signed by Messrs. Steinway, Starin, Spencer, Inman and Bushe, Commissioners; Bowers, Counsel; Bogart, Chief Engineer, and Parsons, Deputy Chief Engineer.

Hopper Tender for Locomotives, Wabash Road.

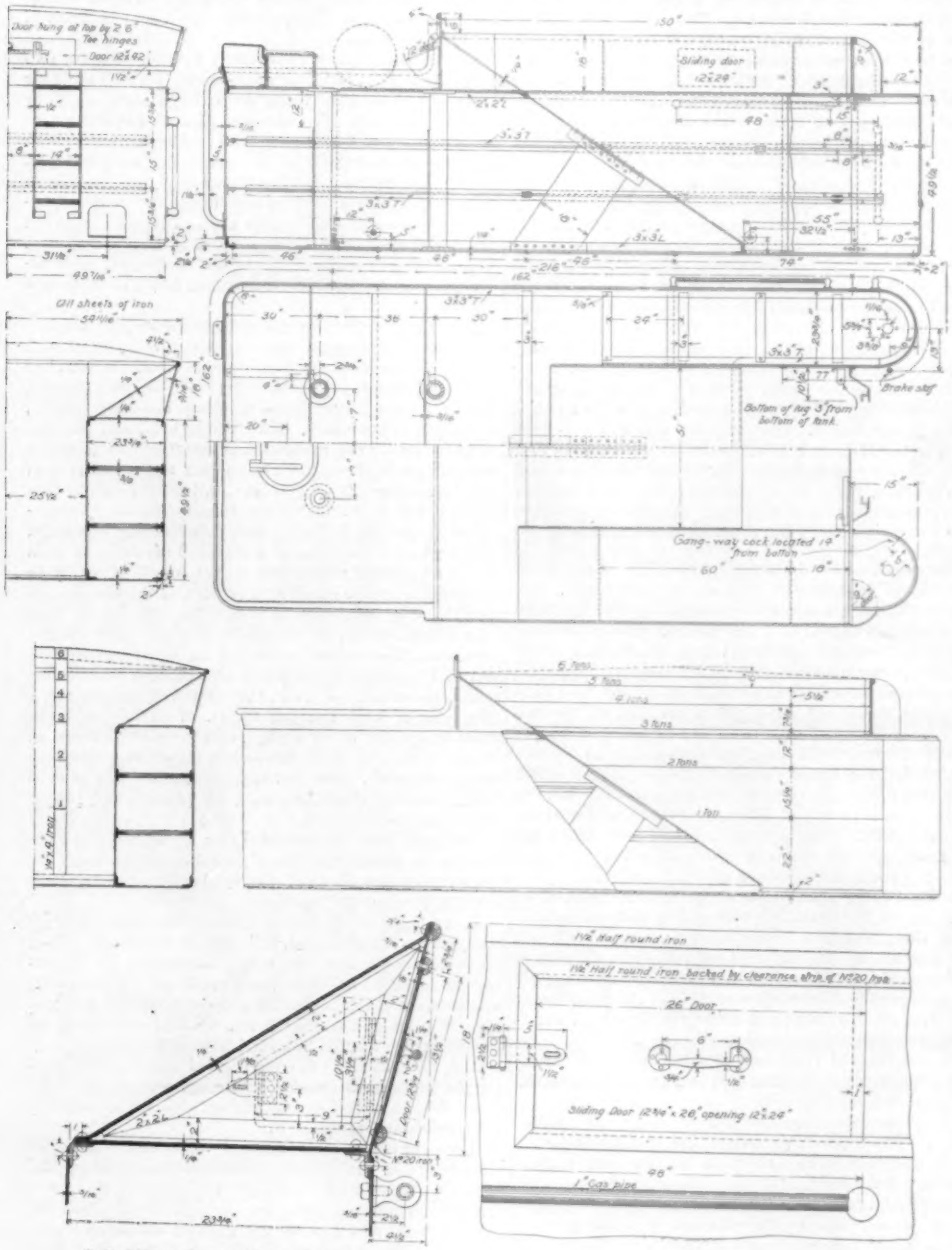
The Hopper tender, designed by Mr. J. B. Barnes, Superintendent of Motive Power and Machinery, Wabash Railroad, which is illustrated by our engravings, has so many good features that it is worthy of careful examination. Referring to the illustrations, it will be seen that the back of the coal space is inclined, as also is the upper part of the sides, with the result that coal naturally falls toward the coal gate, where it is easily accessible to the fireman. There is no place for coal to lodge on top of the tank, and the difficulty of coal remaining on the wings and top unless the fireman takes extra pains to shovel it down, is therefore avoided. There is also a decided advantage in this form for coaling, as it is not so necessary to be particular as to the location of the coaling shute with regard to the tender, as there are no projecting boxes to be struck by falling coal, and there is therefore less waste of coal and less time lost

in coaling. It is said that six tons of coal can be loaded on this form of tender without losing a pound.

Another convenient feature is the marking on the inclined faces of the tender, showing, as will be seen from the engraving, just how much coal is contained in the coal space. From this it is easy to see how much coal is being carried or how much is being received at the coal stations, and in this way the engineer can check the amount received by him. The tank has a capacity of 3,600 gallons, or 19 gallons more than the ordinary form of tank, although the outside dimensions are very similar.

Another interesting feature is the absence of wooden boxes and the arrangement for keeping oil cans and supplies in the wings where they are protected from the weather, and are more readily accessible than with the old style of wooden boxes. It will be seen that this gives triangular tool and supply boxes which, as shown by the drawings, are accessible by an opening 12 x 24 in. on the outside of the tender, and also by the triangular doors in front of the tool boxes.

Several of these tenders, which were originally designed for the Wabash "F" engines, are in use, and it is proposed to substitute them for the usual form as rapidly as possible. It is said that they are very much liked by the enginemen and firemen on account of the great convenience of the arrangement in general. It will be noted that all of the sheets are of iron and no steel is used in the construction.


Door hung at top by 2 6" Tee hinges
Door 12x42
Sliding door 12x24
Oil sheets of iron
Bottom of leg 3 from bottom of tank
Brake staff
Gang-way cock located 19" from bottom
6 Tons
5 Tons
4 Tons
3 Tons
2 Tons
1 Ton
1/2" Half round iron
1/2" Half round iron backed by clearance strip of 1/4"x20 iron
26" Door
Sliding Door 12 3/4" x 26" opening 12 1/2 x 24"
1" Cast pipe

Dotted lines show end door of tool box.

Hopper Tender for Locomotives—Wabash Railroad.

Designed by Mr. J. B. BARNES, *Superintendent Motive Power and Machinery.*

Ships and Shipbuilding on the Great Lakes.

(CONCLUDED.)

Detroit.—At Detroit and Wyandotte are the extensive yards and shops of the Detroit Dry Dock Co., which consist of the engine and boiler works, dry docks and wooden shipbuilding yard comprising the upper yard, the Clark dry docks and yard a short distance down the river, and the metal shipbuilding yard at Wyandotte, 12 miles down the river from Detroit.

At the upper yard the boiler shop has recently been enlarged and to a great extent rebuilt, and is provided with modern tools for heavy boiler work, including hydraulic hoists and riveters. The machine shop is also being remodeled, and when this work is completed there will be a spacious floor for erecting and for heavy machine tools provided with a Shaw overhead traveling crane. This erecting shop space occupies the full height of three stories on one side of the main building, the light tools being placed on gallery floors along the other side. Altogether these shops constitute a well arranged plant for the manufacture of marine engines and boilers.

The Wyandotte yard has been in operation about 21 years and there are naturally some interesting relics in the way of tools which have been replaced by those of heavier and more modern design. There are two slips with broad spaces around them, and the plate shop and office building and mold loft are in line parallel with the river and back from the slips. The keel blocks are laid at right angles with the river so that the yard resembles well known Atlantic coast shipyards much more than other lake yards. Ships are launched into the slips, and with the system of broadside launching generally practiced on the lakes it is practicable to have six ships under construction at the same time. The mold loft at this yard is particularly notable, being very large, well lighted and having an excellent floor.

The following is a list of boats which have been built at these yards during 1892 or are under contract:

A steel freight steamer for the Cleveland Cliffs Mining Co., which is 242 ft. long, 35 ft. beam and 18 ft. depth of hold. The engines are triple expansion and have cylinders 20, 33 and 54 in. in diameter by 42 in. stroke. There are two Scotch boilers 12 ft. by 12 ft., fitted with Howden's system of forced draft. The speed is 16 miles an hour and the cost $125,000.

A wooden ferry-boat which is 130 ft. long, 34½ ft. beam, 13 ft. 7½ in. deep. This boat is fitted with a combination, three cylinder engine, which can be used either as a simple engine or as a compound.

A steel, side-wheel, passenger steamer, which is 165 ft. long, 35 ft. beam and 7 ft. draft. The engines are triple expansion, having cylinders 16, 24 and 38 in. in diameter, with 24 in. stroke, and the two boilers are 7½ ft. in diameter by 21 ft. long. The speed of this boat is 17 miles an hour; it has a capacity for 1,200 people and the cost is $75,000.

A steel freight steamer 293 ft. long, 40 ft. beam and 26 ft. deep, fitted with triple expansion engines and to cost $175,000.

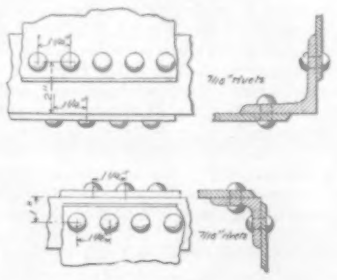
A wooden passenger steamer for the Graham & Morton Transportation Co. which is 217 ft. long, 40 ft. beam and 15 ft. molded depth. The engines are triple expansion, having cylinders 20, 33 and 54 in. in diameter by 42 in. stroke. The boilers, which are 12 ft. in diameter by 14 ft. long, are fitted with Howden's system of forced draft. There are saloon accommodations for 250 passengers, the estimated capacity is 1,200 people, the speed is 17 miles per hour and the cost $225,000.

A wooden ferry-boat for transferring cars, which is 300 ft. long, 52 ft. beam, 25 ft. deep and 17 ft. draft. This boat is to have two compound engines and a propeller at each end for breaking ice. The engines are to be 4,000 H. P. There will be two tracks for carrying cars, and the cost is $300,000.

A steel, straight back steamer for Eddy Bros., of Bay City, which is 362 ft. long, 42 ft. beam and 24 ft. deep. The engines are to be triple expansion and have cylinders 22, 35 and 56 ins. in diameter by 44 in. stroke. The two boilers are to be 14 ft. 2 in. in diameter by 11 ft. 6 in. long. The cost of this steamer is $225,000.

Two steel passenger steamers for the Detroit & Cleveland Steam Navigation Co. which are to be each 264 ft. long, 38 ft. beam and 15 ft. deep. There are to be compound beam engines having cylinders 42 in. in diameter by 7 ft., 5 in. stroke, and 66 in. in diameter by 11 ft. stroke. The four boilers are to be 11 ft. by 11 ft. and fitted for forced draft. The speed is to be 18 miles an hour and the cost $275,000.

A steel freight steamer for the New York Central line which is to be 310 ft. long, 42 ft. beam and 26 ft. deep and is to have triple expansion engines having cylinders 23, 38 and 62 in. in diameter by 48 in. stroke, and two double-end boilers 11½ ft. in diameter by 18 ft. long. The cost of this steamer is $220,000.



Detail of Tank.

Port Huron.—At Port Huron but little building is in progress, and there are no plants for the building of steel or iron ships. Dunford & Alverson have two dry docks at this point, the old dock being at Port Huron, and the new dock, which until the construction of the dock at West Superior was the largest on the lakes, is about two miles south of the city. This dock is 400 ft. long, 62 ft. wide at the gate and 16 ft. deep on the blocks.

West Bay City.—At West Bay City is the shipyard of F. W. Wheeler & Co., at which have been built a remarkably large number of ships in the comparatively short time since this yard was established. In fact, it is a remarkable establishment in many respects. For instance, we should hardly expect to find under construction here a steel tug for use at New Orleans which is to be delivered to her owner at New York, but such is the case, and it is an excellent example of first class marine construction throughout. At this yard have also been built four lightships which are now at various points on the coast of the United States, and treaty obligations have alone prevented the building of ships for the United States Navy. The yard has an extensive water front and ships are usually built parallel with the shore line and launched broadside on. The plate and frame shops are large and well equipped. The machine shop is small and not very well provided with tools for heavy work, and yet excellent work is being turned out. Heavy forgings and large castings are at present made elsewhere.

The new work at this yard is as follows: The tug already mentioned, which is 106 ft. long over all, 23 ft. beam and 11 ft. deep and has triple expansion engines having cylinders 16, 24 and 40 in. in diameter by 28 in. stroke and two boilers 12 ft. 6 in. in diameter by 12 ft. long.

Two steel barges, one for Detroit owners and the other for the Cleveland Transit Co. These are 360 ft. long on the keel, 45 ft. beam and are fitted with triple expansion engines having cylinders 23, 37 and 62 in. diameter by 44 in. stroke, and three Scotch boilers 12 ft. 6 in. diameter by 12 ft. long. The price is about $225,000.

A steel freight steamer for the Mitchell Transit Co., which is similar to those just mentioned, but 32 ft. shorter, to cost $215,000.

A wooden steamer for Hawgood & Canfield, of Cleve-

land which is 291 ft. long on the keel, 41 ft. beam and 23 ft. deep, and also fitted with triple expansion engines.

A wooden schooner 260 ft. long on the keel.

A large amount of wooden shipbuilding has been and is being done at Jas. Davidson's yard, which is also in West Bay City. No metal shipbuilding is done at this yard, which covers a large area and has space for at least seven boats on the stocks at the same time. About 50 vessels have been built at this yard since it was established, about 20 years ago. Engines and boilers for boats built at the Davidson yard are generally built at some of the works already mentioned.

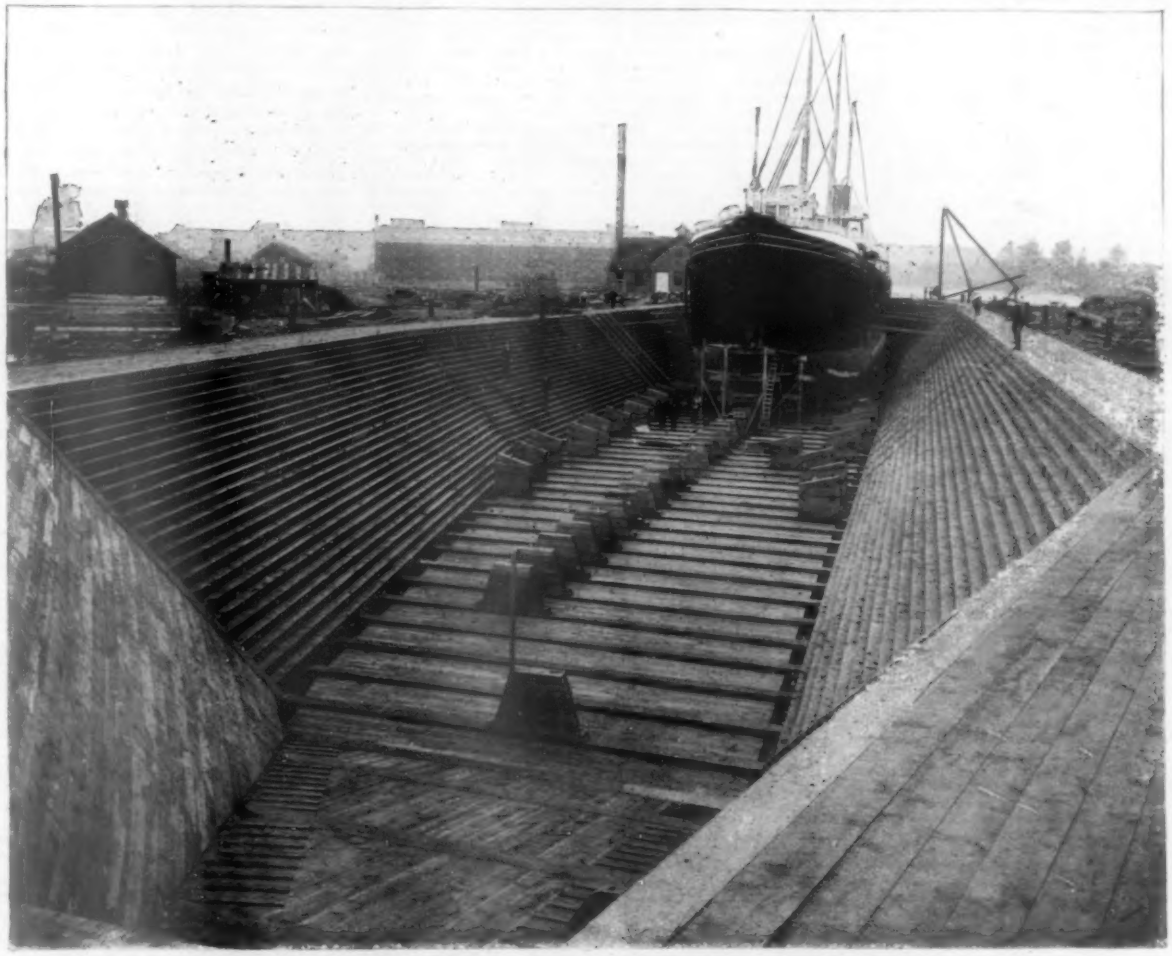
South Chicago.—At South Chicago, between 100th and 102 streets, on the Calumet River, are the works of the Chicago Shipbuilding Co., which is one of the latest additions to the steel shipbuilding plants on the lakes. This yard has been in operation about two years, the first steamer having been launched in March, 1891. At present the company is building hulls only, but provision was made in the general plans for engine and boiler works, etc., to make it a complete plant for marine work in all respects. The yard has a frontage of 1,400 ft. on the Calumet River and has three slips. The ships are built on the spaces between the slips and launched into the latter. Material is delivered to ships on the stocks by means of a steam cantilever derrick of 10 tons' capacity and 120 ft. span, built by the Brown Hoisting & Conveying Co., of Cleveland. The plate shop, machine shop, bending floor, furnaces, etc., are located near the ends of the slips and facing the river, and the mold loft is over these shops. A large proportion of the tools used here are of English and Scotch design. The location of this yard is admirable for shipbuilding purposes, and as there is ample space it is probable that in the near future, when a dry dock and engine and boiler shops and foundry are added, it will be one of the most extensive and complete plants on the lakes. The ships built at this yard have so far been almost wholly steel freight steamers. The first passenger steamer is now under construction. This steamer, which is for the Lake Michigan & Lake Superior Transportation Co., will be 275 ft. long on the keel, 295 ft. over all, 42 ft. beam and 24½ ft. deep. The engines will be triple expansion, having cylinders 25, 38 and 62 in. in diameter by 36 in. stroke. There are to be two double end Scotch boilers 11 ft. 6 in. in diameter by 20 ft. long. The cost of this steamer will be about $300,000.

Milwaukee.—At Milwaukee no steel shipbuilding is done, but there is considerable docking and repairing as would naturally result from the fact of there being no dry docks at other points on Lake Michigan. The Milwaukee Dry Dock Co. has two dry docks, one 312 ft. and the other 355 ft. long on the keel blocks, 47 and 55 ft. wide respectively at the gates, and about 15 ft. 9 in. deep on the sills and blocks. This company recently built a hydraulic sandsucker dredge of large capacity similar to those recently in use on the Pacific Coast.

West Superior.—The shipyard of the American Steel Barge Co., at West Superior, is the latest addition to the list of lake shipbuilding plants, and is devoted almost exclusively to whaleback barges and steamers of the McDougal type. Thus far 30 whalebacks in all have been built, of which 20 have been constructed at the West Superior yard, although it is but two years and four months old. The yard is provided with all the shops and tools ordinarily used in iron and steel hull building and has a large shiphouse containing two sets of keel blocks. There is space for nine ships at a time, the keel blocks being laid parallel with the slips into which all ships are launched. About 90 per cent. of the steel used by this company is made by the West Superior Iron & Steel Co., the plate mill of the latter company being kept busy making plates for the Barge company. During 1891 six whaleback barges, four whaleback steamers and one oil tank barge, having a total net tonnage of 11,453.4 tons, were built at this yard. Eleven more vessels will probably be launched during the present year, consisting of six whaleback steamers, four whaleback barges and one tug, the total net tonnage being 13,918.73. This does not include the World's Fair passenger whaleback, the first of its type, which is 362 ft. long. Four of the 1892 vessels are 320 ft. long, 38 ft. beam and 24 ft. deep; two are 320 ft. long, 42 ft. beam and 25 ft. deep; one is 341 ft. long, 42 ft. beam and 25 ft. deep; two are 265 ft. long, 36 ft. beam and 22 ft. deep, and one is of the same width as the two last but is 20 ft. longer. At the present time engines and boilers are not being built at this yard, but it is probable that a boiler shop will soon be erected.

The dry dock of the American Steel Barge Co., which is the largest dry dock on the lakes, is shown in the accompanying illustration, which is made from a photograph showing the steamer "Neshoto" in the dock, this being the first steamer docked at this point. This dock was completed and tested Sept. 15, and is 537 ft. long, 90 ft. wide, and 16 ft. deep over the sills. As stated in a previous issue, over 2,000,000 ft. of dimension lumber was used in its construction, and upward of 20,000 piles. It can be emptied in from two to two and one-half hours. The dock is situated a short distance from the shipyard, and in the illustration the shiphouse, which is at the eastern end of the yard, can be seen.

The shipyards, and engine and boiler works, which have been briefly described in these articles, comprise the principal works for marine construction on the lakes, but there are many smaller yards which do a considerable amount of building in the aggregate, consisting of wooden steamers, schooners, tugs, etc., and other engine and boiler works which do a large amount of small marine work, and have built many large engines for lakes teamers.



DRYDOCK OF THE AMERICAN STEEL BARGE COMPANY—WEST SUPERIOR.

The Conditions Affecting High Speed of Railroad Trains.

NEW ENGLAND RAILROAD CLUB.

At the November meeting of this club, held on Wednesday evening, the 9th., President Twombly occupied the chair, and the subject, "Higher Speed of Railroad Trains; System and Appliances Necessary to Accomplish It," was opened by Mr. C. A. McAlpine, Superintendent of the Northern Division of the Old Colony. Mr. McAlpine spoke, in substance, as follows:

We are told that Stephenson nearly defeated his object, when advocating the first steam railway, by asserting that trains could be moved at a rate of 12 miles an hour. This was soon accomplished and then began the cry for higher speed. To-day, with trains running regularly at 50 miles an hour, the cry still continues, and increases in a direct ratio with the increase of speed.

The question before us is, not what is possible, but what is practicable. . . . Practically we may answer, the speed which the public will pay for. When the public is willing to pay for a three hours' ride between Boston and New York it can be accommodated. That locomotives can be built capable of attaining a speed of 80 or 90 miles an hour, with light loads, is beyond question, and we can conceive of a railroad so constructed as to admit of such a speed with reasonable safety; but that such a road can be built and operated so as to render a fair return upon the capital invested I believe is not worthy of serious consideration at the present time.

One of the most important things to be considered when we start a train is our ability to stop it. Mr. Westinghouse tells us, that with a perfect brake acting upon all the wheels of an express train running at a speed of 90 miles an hour, at the end of 10 seconds after the application of the brake the train would still be moving at 60 miles an hour, and would have traveled 1,130 ft.; and it would be brought to a stand in about 1,200 ft. more, or 2,330 ft. in all; while under the best actual conditions now existing at the end of 16 seconds the train would be moving at 60 miles an hour and would have traveled about 1,800 ft. With this fact staring us in the face it seems a waste of time to talk of running at such speed on our present tracks and in connection with the ordinary passenger and freight traffic. It is possible to put our present roads in condition to meet the requirements, but there is no reasonable probability that it would result in a sufficiently increased revenue to warrant the outlay.

Mr. Theodore Voorhees tells us that an ideal railroad would be perfectly level and straight, with a roadbed and track heavy, substantial and well drained, with no grade crossings or openings to invite trespassers; with bridges whose floors should be as solid as the roadbed itself, and with stations so planned that no passenger could ever set foot on the track. I would add to this that these tracks must be devoted exclusively to high speed trains, and must be located at a sufficient distance from all other tracks and from each other to avoid the danger, ever present with us now, of an accident on one track causing a ten-fold worse one on the other. Add to this a perfect system of signals constructed with due regard to the capacity of the human eye and operated in connection with a mechanical device automatic and positive in its action, which will, in the event of a failure on the part of an engineman from any cause to obey the signal, bring the train to a stand before reaching the danger point, and with equipment constructed of the best material and under the most rigid inspection, and

we may travel on such a track at 80, 90 or 100 miles an hour with comparative safety. All of these requirements can be met, but only with unlimited capital.

Leaving, then, the question of extraordinary speeds to theorists and the future, can we increase the average express train speed on our first class railroads to, say, 50 and 60 miles an hour, and to what extent does this involve the ordinary or local traffic? The improvements now being made on our trunk lines are fast bringing them into a condition to render them, so far as the track is concerned, more safe for a speed of 60 miles an hour than they formerly were for 30 miles an hour. . . . And the locomotive department may also be regarded as equal to the emergency. But I want to bring up a question which has long been in my mind, and is brought out forcibly by a series of tests made on one of the Shore Line trains between Boston and Providence, and which is a fair example of express train service in New England. This train is scheduled to make the run of 44 miles in 65 minutes, including two stops. Making the liberal allowance of five minutes for the two stops it will be seen that it is only necessary for this train to average 44 miles an hour, and yet it was found that, on seven of the eight trips of the test, the speed during some parts of the run exceeded 70 miles an hour and on one occasion reached 77¼ miles an hour. There is nothing exceptional about this train; similar fluctuations will be found to be the rule in New England.

It is, therefore, apparent that with a locomotive capable of maintaining the present average speed on the up grades, we may increase our average speed to 50 or 60 miles an hour without any increase in the rate we are actually accomplishing daily, as a train can be brought to a stop within a much less distance on an up grade than on a descending or level track, with no increased risk. In other words, can we not best increase the speed by making it more uniform? Next comes the brake. Notwithstanding the wonders already achieved, much remains to be done in this line. We must have double the usual power, and it must be applied to every wheel in the train, not excepting the locomotive trucks. One of our Boston roads has recently applied the truck brake to one of its locomotives with such good results that a large number have been ordered, its efficiency and value being demonstrated beyond question. We must have an automatic device to regulate the brake-shoe pressure according to the speed, so as to avoid skidding of the wheels and consequent loss of efficiency, and all parts of the brake must be strengthened to withstand the increased force to be applied. For emergency stops we must have a sand jet operated simultaneously with the air brake. Devices to accomplish this are brought out for attachment to the locomotive; they should be perfected and attached to the cars as well.

Our next problem is to remove every known danger from the path of our train. At way stations overhead or underground passages should be provided and measures adopted to compel their use. Leading switches should be removed except where they are an absolute necessity, and whenever allowed to exist, should be guarded by an interlocked signal. All sidings should have derailing switches at the fouling point, connected with the main track switch. Draw bridges, junctions and all other points where the tracks are of necessity frequently broken and obstructed should have interlocking switches and signals, and the entire line should be covered by some system of block signals, a purpose to which the electric track circuit seems best adapted as covering the widest range of possible dangers, and being the least dependent on human agency for the faithful performance of its duty. I look for improvements in the application of electricity that will make it the railroad watchman of the future.

All fixed signals should be uniform in form and meaning, and care should be taken not to multiply them needlessly; making it a study to remove or group danger points, whenever possible, rather than add to the number of signals. For night signals electric lights have proved far better and more reliable than the oil lamp and should be used wherever available. In connection with every fixed signal used for a stop signal there should be a device which will apply the brakes and bring a train to a stop whenever the signal indicates danger, independent of any action of the engineman.

With these improvements and additional safeguards it would seem that our train might go on its way in safety, but we have yet to meet one of the worst dangers, that of the freight train, running, not on our track, but upon the track 7 ft. or less away. We must prevent the mishap to the freight train. To do this we must raise the standard of our freight equipment; all old or weak cars must be discarded and the freight car made to carry its load with as much safety as does the passenger coach. The old-fashioned door, which easily slips from its fastenings, has performed its mission and must go. Breaking apart of the train is responsible for more accidents and delays, perhaps, than any other one cause. This must be stopped or reduced to a minimum. To say that it can be stopped may seem a bold statement and I am aware that the coupler problem has not yet reached a point to warrant it, but I have yet to learn any good reason, financial or otherwise, why, pending the solving of that problem, freight cars should not be equipped with safety chains. Their application is simple and comparatively inexpensive, and I firmly believe that if applied to all cars they would more than repay their cost the first year in the saving of accidents and delays. If any gentlemen present has ever tugged a draft chain through three feet of snow from the caboose to the 20th car ahead of it he will agree with me. Stringent regulations may be adopted and enforced to prevent overloading and improper loading of the cars, and better means provided for the securing of such freight as must be carried on open cars; in fact wherever passenger and freight traffic are both conducted over the same or adjacent tracks, equal care for their safety must be exercised.

These, to my mind, are the principal physical and mechanical requirements necessary to higher speed. But we are still dependent on the loyalty of the men engaged in the service. I use the term loyalty because it expresses all that men should be, and it should apply to all ranks from General Manager down. He who is loyal to the company he serves and to himself, will do his best under any and all circumstances and will have the interests of his employers at heart always. More care should be exercised in the selection of men. Applications for positions of responsibility on our roads or from which promotions to positions of responsibility are made should be in writing on a regular form, accompanied by references. Such applications should be referred to a standing committee composed of experienced officials from different departments with a representative employé from the department to which the application was made. Regular dates should be fixed for examinations. . . .

What effect an increase of 25 per cent. in the speed of our express trains will have on the local traffic can only be determined by the volume and character of that traffic. In many cases it will mean equal or greater increase in the speed of local passenger trains, otherwise local trains would have to side track for express trains. The speed of way trains can be increased, but the cost of such increase must be considered as vital to the question at issue, and in this calculation the rapid rate at which the train resistance increases with increased speed will cut an important figure. I do not know that the exact ratio of this increase has ever been determined, but the diagram given us by Mr. Forney is probably approximately correct. From this it appears that on a level track at 40 miles an hour the resistance is about double that at 25 miles an hour, and at 60 miles an hour it has again nearly doubled, being respectively 7, 13 and 25 pounds per ton.

What is a reasonable speed must be determined by each manager for himself and not by the public. . . . We must not encourage a public demand which we are not prepared to meet. The steady increase of traffic calls for improvement in system and appliances to enable us to maintain our present speed with safety. We should meet these requirements before making any attempt at an increase. I am alive to the fact that speed in all things is the order of the day, and I would not be counted as in the rear of the procession, but I do not want to see the dangerous experiment of higher speed without a proportionate advance in system and safety appliances.

DISCUSSION.

Mr. LAUDER: The greatest difficulty in making high speeds is that of getting the track clear of obstructions. Our track is safe enough to make much higher speeds than we do. We do not get an express train on the Providence Division into Boston once a week without encountering little delays which necessitate very high speed to make up for them.

Mr. MARDEN: On the Fitchburg road, even on the curves, we often run 60 miles an hour. It is not economical to run trains at an average of over 45 miles an hour under the present conditions of traffic. To obtain an average of 55 or 60 miles, tracks must be set aside for the use only of these fast express trains, and that would necessitate a four-track road.

Mr. COUGHLIN: One point not yet mentioned is the atmospheric resistance to the train. In naval architecture the endeavor is to remove every point of projection, every line which offers an obstruction in going through the water. Cars can be made conical at both ends, so as to be comfortable, and much less resistance would be offered to the atmosphere.

Mr. CHAMBERLAIN: I think I must take issue with Mr. Marden as to discouraging the high speed of trains. There are now running trains between New York and Boston in five hours forty minutes and before long they will run in five hours, and perhaps in four and a half, or four. I think the business demands this. There are train loads between New York and Boston who would pay ten dollars instead of five to save a couple of hours. Time is money to those passengers.

Mr. MARDEN: I do not wish to be understood as not favoring progress, and I don't object to high speed provided it can be attained with safety. The time of the trains between here and New York is not excessively fast; the average rate, even at five hours, would be less than 50 miles an hour. High speed requires greater elevation on curves; but if we elevate our curves to accommodate trains running at 60 miles an hour, and at the same time run over those tracks a large freight traffic at 15 miles an hour, the wear of the rails is excessive. Looking at comfort and safety at high speed, the way the cars are hung on the truck in order to prevent oscillation on the curves is an important factor. The adjustment of the springs, the bolstering of the truck, and the weight of the car must be considered with reference to the speed the train is to make.

MR. CHAMBERLAIN: The New York Central is designing a locomotive and arranging the tracks for running a fast mail train at 60 miles an hour. It is reasonable to suppose that if a mail train is run at that rate of speed, a passenger train will, before long, be run at the same rate.

MR. LAUDER: Running at high speed is not a question of power. It is purely a question of getting the track to run upon. If we had the track we could make the run to New York at 75 miles an hour. The locomotive and cars as they are now constructed would be equal to it. With regard to oscillation of cars, I think there is a remedy at hand in the Pullman vestibuled cars, which have very little oscillation. They are perfectly coupled together. The motion of the swing-beam in the truck provides for the oscillation that takes place. This absence of swaying is noticeable in our Fall River train, which is vestibuled throughout, and runs at high speed. The weight of the train is not such a terrible bugbear as some seem to think. You have got to have material in your car to make it strong. I believe we shall soon have fast time between Boston and New York. The New Haven road is spending millions to reduce the time on that road. The Boston & Albany is perhaps ahead of any other road in the abolition of grade crossings. That is progress in the right direction.

Mr. ADAMS: I agree with Mr. Coughlin. Cars built with the corners rounded would certainly offer less resistance than cars with square corners. Round-cornered cars could be vestibuled as well as square-cornered ones. Mr. Graham recommends lighter cars. We have a car on our road that has been running 14 years, and is in fair condition yet, which weighs only 30,000 lbs. and carries 78 passengers; but such cars cost more money, and have to be built with more care. We have a number of drawing-room and sleeping-cars that weigh 103,000 lbs. each. You cannot run at very high speeds in the neighborhood of populous cities without four-track roads. It would be a vast expense to four track the New England roads, and I do not think it will be done to any extent at present.

Wreck at Terre Haute.

The engraving printed with this article is reproduced from a photograph showing the very serious consequences which resulted from a rather slight butting collision at Terre Haute, Ind., on Oct. 28. The bridge, which carries the track of the Cleveland, Cincinnati, Chicago & St. Louis road, crosses the Wabash River at an elevation of about 50 ft. above the water. The cars which appear at the right of the engraving were those of a train which had been run upon the bridge for a few minutes to get out of the way of another train, switching in the yard. While it stood there it was run into by the stock train from the opposite direction and a truss was broken sufficiently to cause it to give way, letting both engines and eight cars of cattle and coal into the river. One of the engines was entirely submerged. One engineer was killed, and at last accounts his body had not yet been recovered. The other men on both trains saved themselves. The published accounts indicate that there was fault on both sides; that the brakeman of the standing train did not go far enough with his flag, and that the approaching train was running too fast. A temporary bridge was completed Nov. 3.

WRECK OF A BRIDGE BY A COLLISION AT TERRE HAUTE, IND.

Snow on Railroads.*

Tha effect of a snowfall is felt in the traffic movement on railroads in inverse proportion to the means adopted to prepare for it, the greatest inconvenience being felt in localities where it seldom occurs; consequently a fall considered light in one place has the effect of entirely stopping traffic in others. Various causes go to exaggerate the effect in the southern parts of the snow belt, where snow is more difficult to deal with by reason of the character of the fall, and because of the packing or solidifying which follows attempts to move it.

The subject may be considered under four heads:

I. The numerous ways in which snow falls and settles may be classified as follows: (*a.*) Quietly and steadily at a comparatively high temperature, flakes damp and soft. (*b.*) Similarly at a low temperature, flakes hard, generally small. (*c.*) Passing apparently through a current of colder air than that in which formed, with high wind which results in drifts. In such a case the small flakes harden separately, and being free are easily drifted. (*d.*) One in which the flakes reach the ground apparently through a milder stream of air hardly sufficient to thaw, and when settled freeze into a mass owing to the chilling influence of the earth. (*e.*) Lastly a damp fall followed by a slight thaw after low temperature upon very cold ground; this is the cause of ice forming under the snow, and is the worst condition to deal with.

II. Falls such as described in (I., *a.*), although greater in bulk, are the easiest to remove. Occurring most frequently at the commencement of a winter, and the fall being of uniform depth, pushing the snow aside is sufficient to open a road. The greatest difficulty in dealing with such snow is its eddying into the ash pan or firebox, reducing both draft and steam. The fall described in (I., *b.*) is frequently more troublesome if its depth exceeds a couple of inches, as it fills the rail flanges (so called) and makes it difficult for the wheels of engines and cars to touch the rail and get the proper adhesion and smooth running surface. When a fall like

* Extracts from a paper by J. W. Harkom, M. Can. Soc. C. E. Published in the *Transactions* of the Canadian Society of Civil Engineers.

(I., *c.*) occurs, the season being advanced and a surface of hard, smooth snow (especially after a thaw and subsequent drop in temperature) is offered for it to drift over, the trouble begins.

In localities where a road curves considerably, a change of wind has in a couple of hours been known to clear out blocked cuttings and to fill others which were clear. A fall as described in (I., *d.*) is happily not frequent, chiefly occurring toward the end of a winter, and in open country rather than in a wooded or hilly one, it being necessary to the formation of such drifts that the wind should have a clear sweep and unchecked velocity to move the snow; when packed as described it is like stone to deal with, huge drifts being able to carry any weight without breaking through, the ordinary wooden shovel being useless for moving it. These are the drifts which cause the most derailments, and being often "side drifts," so called from their covering the road bed unequally, sometimes many feet high on one side and a few inches on the other, are very dangerous. Even when of uniform depth across the track they do great damage, allowing engine wheels and plows to roll or slide up them rather than break through to the rail, and "ditching" is a common result. Another very dangerous kind of drift may be included under this heading, viz., when earthen banks (generally sand) have been exposed by thaws, wind and snow sweeping over gather particles, which, mingling with the snow, form a very solid and difficult obstruction to remove. In the case of falls like (I., *e.*) the packed matter when not cleared by proper appliances, is dangerous, ice being formed on rails after the passage of wheels. Where drainage is bad the ice forms sooner, and when formed nothing but a man with a pick-axe or similar appliance will remove it.

III. The methods of dealing with snow may be divided into two classes, viz.: "preventive" and "curative." Of the former, many brilliant propositions have been heard, including the warming of the roadbed by steampipes to thaw the snow as it comes to rest. That in general use is a "snow fence." Snow sheds are used in many places, but they may be classed with fences.

When building a railroad in a snowy district, care is now generally taken to raise the roadbed above the general level of the ground. Three feet to rail level is sufficient, and even a less height has given good results. Of "cures" there are two forms, viz., snow-plows and snow-scrapers. There are four kinds of plows, viz: independent plows, pushed by an engine. "Rotary," or machine plows. Wing plows. Nose plows built on engines. Of scrapers there are two chief types, viz.: 1st. That placed on the pilot of engine, and, secondly, that built on a car and when in use towed behind a train.

Fences.—Prevention being better than cure the snow fence stands first in merit among the successful methods of dealing with snow. The best fence for this purpose is a hedge row of small evergreen trees. The common balsam or cedar is recommended, and when planted in three or four rows—the trees in one row covering the intervals in the other—the result is a snow fence that will never fail.

The location of any snow fence is necessarily governed by the direction of prevailing winds and the general features of the ground, but it should never be within fifty feet of the centre of the track, thus giving room clear of the roadbed for the formation of the drift. Excellent results have been attained by the setting up of temporary fences at greater distances than this, and in very bad places a good plan is to set up a double line, one hundred feet apart. Snow walls have been cheaply built and with good effect, but in strong winds they are liable to be leveled and their tops blown away. To prevent this the author suggests the topping of a snow wall with a board nailed to a couple of stakes. Portable wooden fences, in the shape of strong hurdles, are excellent auxiliaries of this class, both for "first" and "second line" fences.

The author has not thought it necessary to enter here into the construction of snowsheds, the general principles—laid down above—being sufficient for this paper. It should not, however, be forgotten that the hauling of trains within any such sheds is a matter of trouble and difficulty, as the rail in them is often "bad," either "greasy" in summer or "frosty" in winter, and keeping the track to surface increases the trackman's duties. There is also the fire risk. The author emphatically indorses the principle of *keeping the snow off* the road as the best way to work a railroad. A certain amount of snow on the banks is a benefit, materially reducing the ill effects of frost on the roadbed.

Plows.—In discussing plows those used on single track will be first considered. The accepted type is the wedge or V nose. This plow does its work well in an even fall of snow up to 2 ft. deep, but the majority of them do not *clear* snow of greater depth because they cannot dispose of more than that quantity through the curved discharge at top, which is nearly always too small. The deeply drifted snow either piles on top of the plow or breaking it off falls close to the channel cut out and so back upon the track. Another fault in construction is that the V-nose leads the snow to the side of the plow too soon, delivering it too close to the track. The idea of the original designers appears to have been, to turn a furrow, as a farmer in the field; but snow should be first lifted and then delivered at the side as far from the track as possible. To secure this the roadmasters call for *fast running*. To assist such plows to deliver snow far from the track the curved delivery should be of a greater capacity, and a practical rule for design would be to make it at least one-half the total depth of plow, for it must be remembered that to do the work intended it has to pass to each side one-half of the snow the plow runs through. A brief consideration will show that for a plow 10 ft. wide, working in snow 3 ft. deep, the area of this portion should be 15 sq. ft., or the snow will go over top or fall at sides of plow and close to track.

A better design of plow has been coming into use of late years, in which the nose is square instead of V-shaped, and the best snow clearing under the author's observation has been done by them. This design is much safar, as it will lift a side drift, and when one side is full will pass the snow to the opposite side. The author has had personal experience with a plow of this pattern for ten years and it never failed in any kind of drift or got off the track.

A pattern of plow much in favor on some roads is a large wing plow, which can be used for breaking a road first and afterward for widening the snow banks and scraping the rail. They generally have in front a movable apron for scraping flanges. This plow is very high, has a square nose and an unusually high delivery. Excellent work has been done with them, but they must be run at high speed, which, in front of an engine, is open to serious objection.

We now come to machine plows. Of these the best is the "rotary," and with it wonderful work has been done, but it should never be lost sight of, that although unrivaled for emptying a full cutting, the cutting should not have been allowed to get full. Its progress is slow, but its does its work effectively. It is expensive to operate, but less so and leaves its work in better shape than "a shovel brigade."

The "wing plow" is the most effective ally a roadmaster has in moving snow back from the track after the ordinary breaking plow has passed through. The author has for two winters had a winged plow operated by compressed air, each wing being connected by a rod and piston to a 10-in. cylinder, having a motion of 3 ft., sufficient to fully extend the wings and allow them to return home to sides of plow. The return pull is secured by two cylinders of the same size working with a shorter stroke coupled close to the hinge of the wing. Air pressure is admitted to each wing by a three-way cock, handled by the look-out man. One great advantage claimed for compressed air is that, should a drift be too heavy, the wings, instead of being held out until the pinion, its dog or the rack breaks, or the engine is stuck, will close in until the pressures equalize. Then, if necessary, the plow is backed up and another run taken to finish the job. The working pressure on the wings can be so regulated that resistance need not exceed the tractive force of the engine. It has been assumed in the foregoing that the winged plow is hauled behind the locomotive, as no plow with men in it should be run in front of an engine. Using an apron in front of a wing plow in opening a road is very dangerous, the apron being liable to be raised by drifts and derailment follows. It is after the road has been opened for engine passage that the apron will do good.

Another machine plow, the "Parks," has been for many years in use on the Grand Trunk Railway, but it is only a heavy scraper, and its construction in front is such that it must leave the track in a deep side drift, the author therefore considers it should be classed among scrapers, not among plows. The front offers no opportunity for snow to pass from one side to the other, and in a deep drift the wedging action of the Y front forces the wheels off the track. In a couple of feet of snow with no banks, it is effective, but being a machine plow men have to ride in it, and it should not be run in front of an engine. It becomes, therefore, for practical purposes only a scraper, but it is the very best of scrapers.

The common shape of the double track plow is with a square nose. This practically shovels up all the snow in front, passing it to the outside of track. The matter of clearance is of great importance in this plow, but has apparently not received the attention deserved, as the clearance instead of being double that required in a single track plow is, so far as the author has noticed, no greater than that given to single plows.

Of fixed or engine nose plows there are a variety, and some have been patented. They are generally of sheet iron with square nose, practically a large shovel. An objection to this class is that they are troublesome when the engine backs up, gathering snow underneath, and eventually either stalling the engine or breaking the plow. The author has given much attention to engine plows and describes one built and successfully running (worked both forward and backward) on the Drummond Counties Railway, Province of Quebec, during two winters. This has guards on the side which keep the snow out of the plow when backing up, and a heavy triangular scraper hung underneath at the front end, made an excellent road. In March 1891, one of these plows assisted by an engine broke through, near Barrie, Ontario, at one run, a drift a quarter of a mile long and from four to six ft. deep although only designed to work its way through two or three feet of snow. The square front of the plow has been found to give the greatest safety, no case of derailment in any kind of drift having been experienced. For several winters on the Athabaska and Doucet's Lauding Branch, Grand Trunk Railway, one of these plows did good work keeping that track open, the train always getting through.

Scrapers.—We next come to scrapers; considering first those used on engines. There have been two kinds used on the Grand Trunk Railway as noticed by the author. The first was the "Goulette," the design of an intelligent conductor, who no doubt had many times, in the early days taken his turn at holding the shovel on the rail in front of an engine to help it up a grade in stormy weather. His design—which was to hold the shovel mechanically—has been superseded by the "Temple" scraper fitted to the pilots of engines. This consists of an iron body hinged loosely at the front end and lifted off or lowered to the rail by an arm on a crank shaft worked by the engineman from the cab. To this body is attached a steel blade hung by hinges at the top and held in a vertical position when working by two steel springs, thus allowing the blade in case of being accidentally run on to a switch or other obstruction to give way or slide over it. The author has seen these scrapers do work that had previously been considered work for an independent plow. Care has to be taken in fitting the scrapers that they are always of the same figure on the bottom of blades, and that when on the rail the whole stands level, failing this precaution they will not work alike, the work being unevenly distributed, by reason of some having to scrape hard snow left by the others. They cannot do such work, and hence the scraper gets the discredit which is properly due to want of uniformity and care in fitting.

We next come to the scraper fixed to a car and worked at the rear of the train. The "Goulette" scraper is a crude arrangement of heavy moulded blade set at an angle to the rail and shaped to cut a space ten inches wide, one inch and a half below rail level inside the rails and down to rail level outside the rails. It is operated by a man moving a heavy lever attached to the framework carrying the scrapers, a set being fitted on each end of the car outside the wheels, so that running in either direction, the last thing on the train is the scraper and no serious damage is likely to result from failure to lift it at switches, crossings, etc., as not infrequently happens on account of the uncomfortable position of the man working it. The Maine Central Railway has improved on this arrangement, putting the scraper in the centre of the car and working it by men in the body of car, which is a better position for the "lookout." A similar construction on the Portland Division, Grand Trunk Railway, under the supervision of the author has done its work well for years, with comfort to the men and without derailment. The arrangement for working is more convenient, certain and rapid in action, and the scraper is so made that on striking a switch or crossing plank, it only breaks off the part below the rail. This cannot throw a wheel off, and the injury can be repaired in a few minutes. The author has heard of scrapers of this class being used on the American Pacific Railroads in the Rocky Mountains which are operated by compressed air. Doubtless they did good work, air being quick and sure in its action.

How to Deal With Snow.—The question of cuts and fills will always in uneven country have in connection with first cost a very important part in governing the profile of a road, at the same time in the case of roads liable to be visited by snow the avoidance of snow troubles should be taken into consideration, and where possible cuttings should be made wide and shallow to give room for drifting. On prairies the rails should be three feet above ground level, then neither snow fences nor snow plows will be required, engine scrapers with an occasional trip of the car scraper being sufficient to thoroughly clean out the flanges.

Fences are by far the cheapest method of dealing with snow; they require no wages, and do better work than a gang of men shoveling. The latter, unless great expense is incurred in casting the snow a long distance back, only aggravate the difficulties of future storms. Intelligent and thorough observation of the prevailing winds will assist in locating fences, which as before stated should be put well back from the track, and not necessarily placed parallel with it.

When it is known that a heavy storm is commencing, start no feights, and make arrangements to run ploughs ahead of passenger trains to keep the road open. This enables freight trains to be started out directly the storm abates and on the first sign of abatement, preparations should be made to shovel out sidings and switchings to prevent delay. As a rule, work of this kind done during a storm is wasted. A careful and thorough system of telegraphic reports of weather from all parts of the line in addition to the meteorological predictions, should be enforced; train loads and movements can then be safely arranged.

However, let us suppose that in spite of all precautions a heavy block has occurred, that some cutting has drifted full, the ordinary plow has failed to make its way through, and assistance is asked for. Intelligent action is then necessary to prevent damage to rolling stock. It has only too often been the practice to put extra engines on and try to ram the plow through, usually resulting in smashing it and the engines. A good rule is "that what one engine and plow cannot go through is not safe to run at."

In coupling plows to engines it is necessary to couple closely with small short links to allow the plow to break away from the engine in case it jumps the track. These small links are not to be used for pulling the plows but only in pushing. Sometimes if the snow is soft and damp, although deep, two or three engines moving at a walking pace can push a plow through it safely, but if the temperature is low that cannot be done, the drifted snow being so hard that one might as well try to dig the cutting out of the original earth by the same means. Under these conditions the "rotary" if on hand will do good work. If the drift is not more than 6 or 7 ft. deep the line can be opened quickly by taking a gang of men and setting to work in pairs, about 15 ft. apart, to digs cuts *across* the track about 12 ft. wide and just long enough for themslves to work in, going down till they find the rail, and leaving it bare for a couple of feet in length. Two hours of this kind of work with a gang of 20 men will prepare for opening a long cutting. When all is ready the plow will at every opening get relief and the engine a chance to work. The cut being opened it should be widened in preparation for another storm. Unless this widening is done at once there is no certainty that the cut will not soon be worse than the previous storm left it. A roadmaster should never neglect the widening of snow cutting and the leveling down of banks close to the rail. The wing plow is a good auxiliary for this work, but frequently where the rotary is not used snow must be carried away on flat cars.

The clearing out of the mouths of the culverts to admit the free passage of melted snow is very necessary, and general freedom of drainage requires attention. Thaws and rain are often sudden, and as promptly followed by fall in temperature tending to freeze the road solid in a short time.

When ice has formed on the track it can only be removed by the pickaxe. No plow or scraper can clean the rails, and any attempts to force engines over or through it before a thaw has thoroughly set in must result in disaster. Resort must be had to hand labor to clean the rails and flanges, and is a costly undertaking.

A serious problem has presented itself of late years in dealing with snow on roads of two or more parallel tracks. The author suggests the following system: Starting out with the theory that in clearing a line of snow between any two given points (whether on single or double track) no trains should be on that portion of the line while the clearing is in progress. Assuming that it is desired to clear a "section" of snow and that at each divisional terminus there is held in reserve a complete equipment; it is necessary to note the direction of the wind in order that the plows may start from that end of the road which will give the action of the side plows the assistance of the wind in carrying all the loose snow stirred up to the same side as the plow is putting it. For example sake we will take it for granted that a storm is blowing from the north, on a double track running east and west, and that the practice is to use the left-hand track, consequently the side plows are built to throw snow to that side. In this case the plows should run from the east to the west, and the first "section"—say twenty or thirty miles—secured clear of trains. Both tracks being clear of trains, running orders west are first given the eastbound or north track to one plow to the end of the selected "section." The plow being the ordinary square-nosed plow is pushed by the engine, the hauled wing plow follows later to force back the bank on the north side and to clear the most of the centre between tracks, throwing this snow well over on to the south track, helping the second side plow to move it further south and by a wing plow following to force back the bank on the south side.

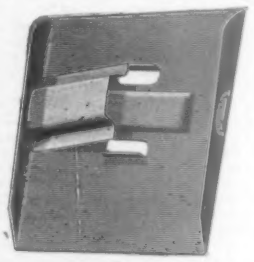
The advantage of this plan is that this "section" is entirely cleared at once, and traffic can be safely resumed on it. On arrival of all plows at the end of the section the trains there may be crossed or passed, and a second "section" of the "division" treated in the same manner.

A Hint for Mosquito Nets.

An electric insect destroyer, described in *La Lumière Electrique*, and about to be patented in Germany, consists of an electric arc lamp, surrounded by a network of fine platinum wire. This wire network serves the purpose of a rheostat, and is brought to a high temperature without, however, becoming incandescent. The insects are supposed to be attracted by the light and, not seeing the wires, to be burnt by coming in contact with them. The whole contrivance is surrounded by a large meshed wire cage which is designed to prevent harm to birds but which will readily allow the smaller insects to pass.

Pressed Steel Hewitt Lid.

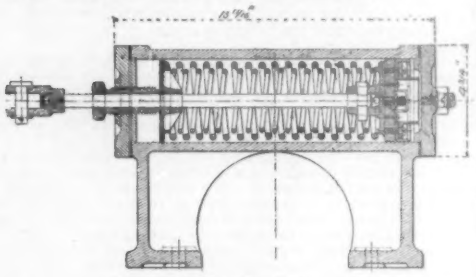
Among the recent novelties in pressed steel is the Hewitt lid, manufactured by the Drexel Railway Supply Co., which is illustrated by the accompanying cuts. When intended for use on new cars the lid is made of two pieces. The lid proper is shaped out of sheet steel, and two holes are cut in its flanges to receive the key which forms the lugs. This consists of a single piece pressed into a shape similar to the lugs on the old Hewitt lid. This is pushed through the holes in the flanges so as to project equally on each side. After the lid is set to the box this cannot slip out again, but becomes, in fact, a part of the lid. The form which is shown in the cuts is intended for repairs and is similar in every respect, excepting that the key is cut in two in the middle. With this arrangement the lid can be set in between the projections on the box from the front without removing the arch bars, the two keys can then be pushed through the holes in the flanges on both sides until they project into the ways when their inner ends will abut. The two small stops or clasps, forced up from the body of the lid above and below the keys, are then hammered down and the three pieces then become as one. In hammering down these clasps the lid is pushed up until these rest over a solid part of the box. The lid is made in several different sizes and the lugs are set at various distances along the flanges, so that the lid can be made to fit any box, no matter how worn.



This lid is very light, weighing but 28 ounces, which is, of course, a decided advantage.

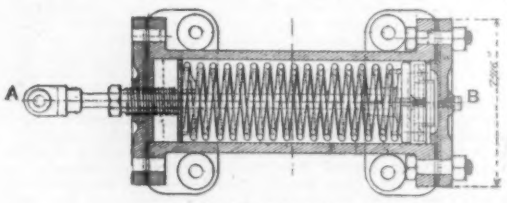
A Spring for Single Wire Signal Connections.

A French engineer, M. Laforest, has designed the arrangement shown in the engravings as a substitute for a counterweight for returning wire connected signals to the danger position. It has been adopted by the Western railroad of France and is being tried by the Eastern and the Southern systems. The especial object has been to get rid of the shocks caused by the counterweight which are supposed to be liable to break the colored glasses and do other damage to the apparatus. The engravings show a vertical and a horizontal section.



Section on A B.

The attachment consists of an iron cylinder, closed at the ends. Within the cylinder is a metal piston whose rod extends through one of the cylinder heads and is properly attached to the signal connections. The piston is fitted with cup leather packing insuring tightness in the cylinder. A stiff, duplex, helical spring is interposed between the piston and the cylinder head through which the rod passes. It is this spring which, bearing directly against the piston, performs the function of the counterweight, actuating the signal.



Horizontal Section.

Laforest's Spring for Wire Connected Signals.

The piston is provided with an air valve which allows the air to pass from the space at the left to the space at the right of the piston, while the piston is moving to the left. When the piston again moves back to its original position under the influence of the spring, the valve, of course, closes and affords an air cushion by confining the air at the right of the piston, except in so far as it is enabled to escape through a relief hole in the right hand cylinder head. The amount of opening afforded by this relief hole may be regulated by a screw plug so that the air may escape more or less quickly as desired, thus affecting the speed with which the piston accomplishes its return stroke.

The Fuel Supply for Indian Railroads.

The *Indian Engineer* in a recent discussion of the coal fields of India expresses the hope that the day is coming "when foreign coal and patent fuel will be unknown quantities in Indian railway working." As a basis for this hope it gives the output of the various collieries of the country and the extent to which their product is used as a steam coal by the railroads. It seems that more than 750,000 tons of Indian coal, or about three-quarters of their total consumption, was used by the railroads in 1891, although the total quantity of coal raised was somewhat less than during the previous twelve months.

In a résumé of the output of ten collieries it is shown just the amount of loss of output, and the prices paid On the Great Indian Peninsula Railway, English coal is largely used at a cost of $5.61 per ton, though a large portion of its fuel supply was Indian coal costing $1.40, the reason for the use of English coal at all being apparently that the Indian cannot be obtained. Again the South Indian Railway uses English, Australian and Bengal coal, patent fuel and wood, the average cost of which works out to $6.12 per ton and 9 cents per train mile.

The East Indian Railway enjoyed the cheapest fuel supply, the average price paid per ton of coal, with an average haul of 227 miles, being only 71 cents, or 1.6 cents per train mile. The Bengal-Nagpur and Eastern Bengal lines come next with $1.45 and $1.56 per ton respectively, while the list is headed by the Bhavnagar Gondal-Junagarh-Porbandar Railway, which uses English coal exclusively, for which it pays an average of $7.50 per ton. The Bengal coal used on the Rajputana-Mahva line costs $6.41.

The principal Indian collieries are the Kurhurbaree and Serampore, which raised 331,064 tons at a cost of 42 cents per ton. Coke is manufactured at these collieries and, during the year, the output amounted to 27,971 tons. The Darjeeling coal field is not yet sufficiently opened to warrant a definite opinion, but such coal as has been met with is very friable, and it is doubtful if the field can be developed without very considerable expenditure.

At Makum the output was 162,213 tons, while at Warora it was only 122,432 tons, or 20,000 tons less than in 1891. This colliery supplies the Great Indian Railway, with a large proportion of its fuel at a cost of $1.40 per ton. English coal is also largely used on this road at a cost of $5.61 per ton, so the sooner it can obtain the whole of its supplies from Indian sources the better it will prove for its yearly balance sheet.

At Daltongunge borings have shown the existence of two seams, having a thickness of 7½ ft., and 13 ft. of a coal resembling Bengal coal, which gives little flame and burns with an intense red heat with scarcely any smoke. In actual trials it requires from 35 to 38 lbs. per train mile.

At Bhaganwala a clean free burning lignite has been found in a seam varying from 48 in. to 63 in. in thickness. It is thought that the field holds not less than 6,000,000 tons, which are readily accessible at a cost of $1.65 per ton.

The Khattan oil wells have been closed on account of failure. The step was not taken before a fair trial had been made, but borings were put down to depths of 740 ft. and 1,338 ft. respectively without satisfactory results, and the brief existence of the Khattan oil works has come to a close after having supplied, from the beginning, 399,600 gallons of oil to the Chaman Extension Railway. Much of the product of Indian collieries makes excellent steam coal, especially that from Assam and the majority of the Bengal coal fields, and the reason it is not used to the exclusion of wood, English or Australian coal or patent fuel is only due to the distance over which it is necessary in some cases to haul it.

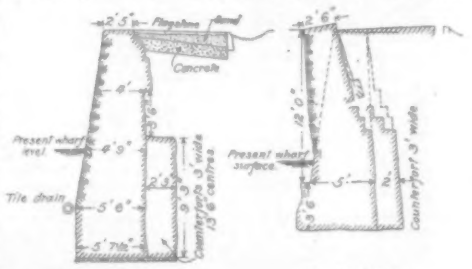
For the above figures of cost we have taken the rupee at 33 cents.

An Old Revetment Wall.*

The old revetment wall along the city front in Montreal Harbor is a very instructive example for civil engineers—more instructive than modern examples of massive masonry which show no signs of failure and in which there may be much surplus strength, and hence much unnecessary capital buried. It is an example of a wall so nearly equal to the requirements that part of it remains in good condition, while part has failed. The accompanying cross sections show that the wall is much lighter than the practice of the present day warrants for similar situations, as is seen by comparing its cross section with that of the Canadian Pacific Railway revetment wall recently built, and yet after 50 years' duty a considerable part of the wall is but little disturbed, and with a similar rate of degeneration would not be in bad condition 50 years hence, while part has failed so badly that it became unsafe, and timber props were resorted to several years ago. Part of the wall was built in 1831 and part in 1840-41. The failure during recent years has been very gradual and the displacement probably nearly equal from year to year. Parts of both the older and newer portions of the wall have failed. Their cross sections differ but little. This seems to indicate that the wall of 1831 had not shown signs of failure in 1841, otherwise the newer wall would likely have been built heavier. The wall is an ordinary retaining wall to support a city street. In the rear the ground rises rapidly in part, and in part is level for a considerable distance back. The wall is about one mile long and on the harbor side is bare for a height of about 10 ft. from the wharf level to the coping.

In the beginning of winter, but always after a considerable interval of severe frost, in which the thermometer usually goes below zero, the river rises until the wall is partly immersed, the average height reached by the river at the "taking" of the ice being, for the last 40 years, a level within 5 ft. of the coping of the wall, varying, however, much from this level, often being lower and frequently nearly up to the coping. After the ice becomes stationary on the river the water falls gradually and usually recedes from the foot of the wall, but at times remains for a long period in winter 1 to 3 ft. up on the face of the wall, fluctuating 1 to 2 ft. with variations in the temperature of the air. Part of the wall in this way is often exposed to temperatures of 15 degs. to 20 degs. below zero after being immersed in water for days or weeks. But this does not seem to be the determining cause of failure, for the best and worst parts of the wall have been equally exposed to these conditions. The masonry on the inclined surface of the ramps, however, at about 1 to 3 ft. above wharf level is much displaced.

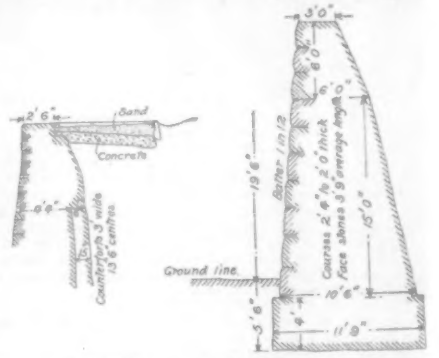
The wall is built of limestone from quarries in the vicinity of Montreal. A few stones are cracked and somewhat weathered, but sufficient disintegration has not taken place in the stones themselves to perceptibly affect the general stability of the structure. The face is



Built 1831. *Built* 1840-41.

bush hammered ashlar backed with rubble masonry. The face courses vary from 10 in. to 13 in. in thickness, but are in general 11 or 12 in. thick, and the stones in certain parts average 3 ft. in length; in other parts 3 ft. 5 in. The bed joints average 0 22 in. in thickness. The coping stones average 5 ft. 2 in. in length, 12 in. in thickness and 2 ft. 6 in. in width.

The wall has failed by sliding on the joints especially at 8 to 10 ft. down from the coping or one to two above the wharf, and by revolving on the joints, but as no systematic observations are available, it is uncertain whether these two motions have taken place simultaneously, or that the revolving began after the sliding movement had seriously affected the equilibrium of the wall. The sliding movement amounts to five inches in a single course in certain places, and a very slight displacement on joints seems to have taken place even in the best portions of the wall, but are here so slight as to make it uncertain whether the irregularities observable



Built 1831. *C. P. Ry. Wall, Built* 1884.

An Old Revetment Wall.

are due to imperfections in the setting or to subsequent movement. The mortar seems to have lost all its bonding strength and as picked from the joints appears as a granulated mixture of earthy materials and lime.

No openings or "weepers" appear on the face of the wall to drain water from behind. Where excavations have been made near the best parts of the wall the foundation is a coarse sand, apparently the old river beach, and this porous material no doubt has served a useful purpose in draining the wall, but the examinations have not yet been extensive enough to warrant the conclusion that the superior condition of the wall here is wholly due to this cause. Fortunately the wall has served its purpose, and must be taken down and entirely obliterated in carrying out the general harbor improvement project lately adopted, and this would be necessary even if the wall were in the best condition. When this is done, something more may be learned of weak points of the wall and of the causes that preserved or destroyed it.

DISCUSSION.

MR. IRWIN said it is not at all surprising that the Harbor revetment wall failed as much as it did. It has no weep holes in its face. The two upper sections have no frost batter, and the counterforts in those sections have not been carried up sufficiently high. It would appear from what Mr. Sproule says with regard to the filling behind parts of the wall that have not been pushed out of place, that had weep holes been left in the face of the wall, and had the back been filled in with small stone or gravel, so as to let the water behind drain out, and the counterforts been carried up to the top, and a frost batter provided with a smooth current face, the wall would probably not have failed at all.

The slipping of the courses over each other, which the speaker observed in another wall which did not fail altogether, seems to disprove the statement often seen in

* From a paper by J. W. Sproule, published in the *Transactions* of the Canadian Society of Civil Engineers.

text books to the effect that if the wall is strong enough to stand there is no fear of the stones sliding on each other.

The retaining wall of the Canadian Pacific Railway, and which looks much thicker than the Harbor wall, was built to carry, not only the filling behind it, but also a double line of railway along which heavy trains and engines pass at considerable speed, in some places round pretty sharp curves; the wall, therefore, had to be built strong enough to prevent the possibility of any movement at all, as any failure would result in a serious accident. With regard to the sections of the Harbor Wall which did not fail, possibly the layer of concrete under the sidewalk, and just behind the wall, may have saved it, partly by keeping water from getting in close behind the wall, and partly by keeping the frost out.

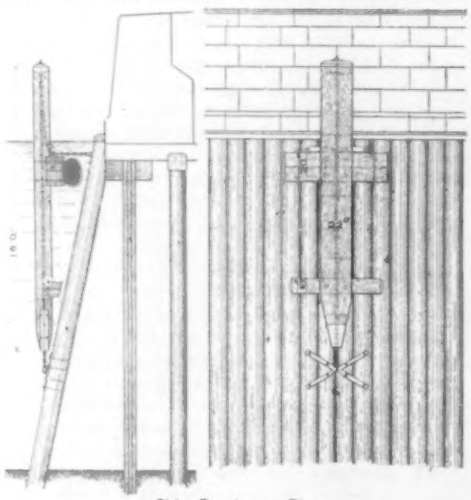
MR. ROBERTSON said the section of the 1831 wall seems to be weak at the wharf level, but from the sections, it seems to have stood better than the wall of 1840. The absence of weepers was probably to prevent the water rising behind the wall when the face was flooded, and then freezing. Was the filling behind these walls of water tight material? The slipping at so many joints may have been caused by the flooding and freezing in open joints, the slipping taking place as the layer of ice melted. It seems to the writer that if the failure was merely caused by the thrust it would not show at so many joints. In a wall exposed as this was to flooding in cold weather the pointing should be attended to every year. The writer does not like the Canadian Pacific wall; unless founded on rock, he thinks the centre of gravity should fall back of the middle of the base, so that when the thrust is applied there will not be such an excess of pressure at the toe.

Mr. DAVY said the failure may be attributed in a great measure to the back of the wall near the top having a slope and the adjacent surface being used as a highway, the constant traffic over which compacts the soil, which, in this case would act like a wedge against the battered back. The incline of the concrete seems to indicate a considerable depression, caused by the traffic on the road, and would indicate the advisability of using a heavier cross section of wall perpendicular for eight feet at least below the surface of the road.

Mr. SPROULE said in answer to Mr. Robertson's question: So far as examined, no provision seems to have been made for drainage behind the wall. The filling varies from sand and ordinary refuse street filling to sticky clay.

Ships' Fenders at the New Riga Docks, Russia.

One of the several interesting arrangements in the new docks at Riga, Russia, completed last year, is that of the fenders, designed to prevent injury to ships and dock walls, and shown in the accompanying illustrations. These we have reproduced from an extensive illustrated description of the Riga harbor works, given in recent issues of the Riga *Industrie—Zeitung*.



Ship Fender at Riga.

The ordinary arrangement of pile fenders could not be adopted at Riga because of difficulties from ice, and a form of construction had to be followed which would admit of ready removal of the fenders during the winter months and whenever the conditions of the ice movement made it desirable. Accordingly the fenders used were made up of two 16 ft., 12 x 12 in., wooden beams, tied together, as shown, but with a clearance space of about 3 in. between them. Two upper cross timbers and one lower one, measuring 10 by 10 in. were bolted on to prevent turning of the fender. The 3-in. clearance between the two main timbers permitted the passing through of a chain which was fastened below to a stout iron cross, as shown more clearly in the front elevation. In order to hold the fender in a vertical position at low tide another chain led from the top to the pile foundation in the manner indicated. A suitably interposed cushion between each fender and the piling prevented violent shocks when the two came together.

In order to remove these fenders, all that is necessary is to loosen the screws holding the chain at the top. The fenders will then come to the surface and the loose ends of the chain can be fastened to the piling. In spring, when the fenders are to be replaced, the chains can again be drawn through them and fastened as before.

A Mountain Railroad.

The Wengernalp Railroad, the latest of the Swiss mountain railroads, is ready to be given over to regular traffic with the beginning of the next summer season. A trial trip over the line was made on Oct. 1 and is said to have been in every way satisfactory. The road was built under the supervisiou of the engineers, Koller and Greulich.

Discrepancy in Chemical Work.*

I have recently seen a series of, I think, 16 determinations of sulphur in a piece of pig iron, supposed to be the same iron, that differed from each other from 0.005 up to 0.02 per cent., or the extreme results (I am giving these figures from memory) were about as 1 to 4. Now, obviously, while the amount of sulphur is excessively small in this case, not being a matter of very great importance, yet, as bearing on the accuracy of chemical work, the result is something appalling. I have seen a series of phosphorus determinations recently, made by six or seven chemists, where the extreme results differed 0.03 to 0.04 per cent. in a total of about 0.10 per cent. I have a friend, who, for a number of years, was manager of a large furnace, who some four or five years ago sent out borings from some pig iron to eight or nine different chemists for phosphorus determination, and when he got the results back, no one of the chemists knowing that any other was working on them, they differed almost as 1 to 2; and, in his nervous, energetic way, he said: "'I said, in my wrath, all chemists are liars!" Perhaps it is not necessary to mention any more discrepancies; I might, however, give one more instance. In a recent analysis of bronze, we obtained in our laboratory, a trifle over 9 per cent. of tin; another chemist, working on what was supposed to be exactly the same metal, being half of the same pig, got over 10 per cent., the discrepancy being about 1¼ per cent. Now, obviously, there is something wrong somewhere.

The first cause of discrepancy in chemical work is that the two chemists did not work on the same sample; or in other words, non-uniformity of samples. Upon this point, your own experience will doubtless give each of you an illustration. At one time we were buying spiral springs on specifications that the carbon should not be below .90 per cent. The springs we examined were made out of a steel wire about a quarter of an inch in diameter, the coil being about an inch and a half across, and five or six inches long, what we call "A" springs, and used to hold the box lids tight to the oil boxes under the cars. We found in those springs so low carbon, in a number of cases, that we rejected them. The manufacturer got some one else to determine the carbon in the steel, and found the requisite amount; and so, of course, the question came up for an explanation as to the discrepancy. The discrepancy was very easily explained, and we, ourselves, in our later work, found the same peculiarity in other steels; the borings required for analysis of these springs were simply what we could get handily, mostly from the outside of the wire. The manufacturer took the same springs, had the outside turned off, and then took his sample from the centre of the wire. This was the cause of the discrepancy, as we have proved by a number of test analyses. Apparently the outer layer of a steel rod that has been heated, as is commonly done with spiral springs, very frequently loses .10 per cent. of carbon in the fire. Or, it may be segregation during cooling explains the difficulty. Of course, it is perfectly obvious that if the samples differ, there is a legitimate and good reason why the analyses should differ. This is especially true of shipments that are made up of large quantities, and are sampled by the single sample. In all our work, when we come to a serious difference between ourselves and any one else, we exchange samples. The second cause for discrepancy in chemical analysis is impurity in the chemicals.

A third cause of discrepancy in chemical analyses is what may generally be called "poor manipulation." I know of chemists who think this is the principal cause. The main cause of discrepancy in chemical analyses, some say, is poor manipulation, or lack of skill. My old teacher in chemistry was characterized by this one very remarkable peculiarity, namely, he never believed anything as long as there was a shadow of doubt, and after all known uncertainty had been removed he was not quite sure; in other words, he was a man who was really a struggler for accuracy. He used to say to me in his very dry way, "No chemist can make an accurate analysis. There are chemists who can work near enough to accuracy so that their work is valuable. There are chemists who can not. And that is the difference between chemists." Of course, what I mean by an accurate analysis is a question of limits. The point I want to make, however, is not a dissertation on accuracy, but the difference between chemists due to manipulation. Undoubtedly, this is a very frequent source of error. Now there is a fourth cause for discrepancy in analyses, if I understand it rightly, and that is the method. I think you will all agree, that two methods may not give exactly the same results.

Now we come to perhaps the most important point in our whole talk, viz., How shall two chemists who differ check each other up? or, come to an agreement with each other? I answer, where two chemists differ, and the difference is due to working on non-uniform samples, or, on not exactly the same sample, the matter is easily checked up by changing samples. Also, differences due to impurity of the chemicals are not very difficult to check up, either by checking up your chemicals, or by the dummy. Sometimes, it is true, the differences due to impurities may be very abstruse and hidden, and difficult to find: but, by changing chemicals, as we have done a number of times, you can frequently locate the difficulty. Also, still further, where manipulation is at fault, it is not a very difficult thing for the two manipulators to get together and work in the presence of each other, as is frequently done, I understand, in Colorado in assaying. These three difficulties—or, rather, discrepancies due to these three causes—are not very hard to overcome; but here comes the poser. Suppose that the difference is due to method, and suppose that I say I have used a good method, an approved method, a published method that is recommended, and you say the same in regard to your method—who is going to decide between us? Both of us are, perhaps, a little obstinate, and both of us perfectly right in the position we have taken. If both of us have used regular, well-recommended methods, who is going to decide between us?

Before answering, let us see what is the necessity for a decision. Oftentimes a good many thousand dollars depends on our work. If we make a mistake by using a bad method, or a wrong method, it may mean a good many thousand dollars to somebody whose product we have rejected. He may have to pay the return freight and have the product sent back on his hands; and, as it doesn't pass specifications, he may not be able, without serious loss, to sell it. On the other hand, if the chemist on the other side has used a bad method, we may have to accept inferior material. As you know, more and more every day, large commercial transactions are based on chemical analyses, and differences between chemists may mean thousands of dollars.

We have proposed the following method for overcoming this difficulty. I do not know that it will be approved by the profession, but we do not see any other way out of it, and many chemists and managing men of the different mills whom we have consulted on the matter have approved the suggestions we have made. The method is simply this: Publish the method we use and make it a part of the specifications. For example, suppose we are buying spring steel on specifications that it shall not contain over .05 per cent. phosphorus. We simply say this to the manufacturer: "We want steel for springs that shall not contain over .05 per cent. of phosphorus, and the phosphorus shall be determined in a given way. Whatever you find by this method, that is the amount of phosphorus so far as our transaction goes." We see no other way out of this difficulty. Now, let us see: this is a pretty bold assumption; the chemist of the Pennsylvania Railroad Co. assumes to dictate to the profession what methods they shall use. Yes; but only for transactions in which the Pennsylvania Railroad is involved. Use any method you choose for your own work; we do not assume to dictate to you a particle; but, as a means of avoiding the difficulty due to difference of method, we simply say to you, arbitrarily, that this is the method that must be used to determine the phosphorus, for example, in transactions where the Pennsylvania Railroad is involved. If we had a standard method, or if any learned society will give a method which shall be regarded and accepted by chemists as final, we will bow to it instantly; we will adopt anybody's method, if it is applicable. We claim no especial originality; we simply give you the method which we use.

Now let us see what is going to come of this. We prescribe a method which shall be used for determining phosphorus, carbon, silicon, sulphur, or whatever it may be. The method as we use it will give certain results; the other chemist will get the same results, at least we assume that he will. The Pennsylvania Railroad Co. puts an upper limit on phosphorus, since phosphorus is injurious to steel—that is to say, the phosphorus must not go above so much; the interest of the railroad company is to have a method that gives as high results as possible, so as to keep phosphorus down. The steel-works chemist, on the other hand, desires that the method in his hands shall show that the steel is low in phosporus, because if it gets above a certain amount it is rejected. In other words, the two parties are on opposite sides of the method. It is one's interest to have a method that will cause the rejection of the steel if it is high in phosphorus, and the other wants a method that will make the steel pass. Now, my experience is that in anything where men's pockets are involved on opposite sides of a question, you are pretty apt to get at the truth sooner or later. This is going to bring a criticism of the method of determining phosphorus by the parties in antagonistic interest. Our thought is this: The method we send out to-day is entirely subject to revision; if any one of you finds a hole in it, say so, and the change will be made just as soon as we can make it, providing your work is confirmed. It is not our method: it is a method to be used to decide certain chemical questions. Our hope is that there will be enough criticism by these parties in antagonistic interest on the various methods put forth, so that sooner or later there will result a method which we will all be willing to accept as standard. It may be that the work of fifty chemists will be required before we get such a method. There is no assumption on our part of superior knowledge, no desire to dictate in any shape or form to the profession; but we have a difficulty to meet, and we cannot see how to get out of it in any other way.

I asked Professor Langley what he thought of it. He said he thought that some learned society should approve the method. Per contra, a member of the American Chemical Society is reported to have said that he would bitterly oppose any attempt on the part of that Society to sanction any method. He did not think any learned body should sanction a method. On the other hand the agricultural chemists of this country, as I understand it, have done this very thing, namely, they have agreed that in the analysis of fertilizers whatever phosphoric acid is shown by a certain method, which they defined in convention, shall be called "soluble" phosphoric acid, and the amount of phosphoric acid that is shown by another method or modification shall be called the "reverted" phosphoric acid, while the amount of phosphoric acid shown by still another method or modification shall be called "insoluble" phosphoric acid. The method was first proposed five or six years ago, has been modified three or four times, and now nearly all the agricultural chemists in the United States, if I am right, are determining the phosphric acid in fertilizers by the method adopted by the agricultural chemists in convention. If some convention would take this work off our shoulders we would be delighted. We assume it only because we do not know how to get along and meet our difficulties in any other way.

We purpose, as I have said, to send out a printed proof of this method for determining phosphorus, and the purchasing agent will send it to all parties from whom we buy steel, so that every chemist who will have to use the method will have a chance at it before it is finally issued. The phosphorus method will come out probably in the next two or three weeks, and we hope to follow it soon with the others. I would say for your information that in doing this it is, of course, incumbent upon us not to send out a method that will not give uniform results; by which I mean that if I make an analysis with any method, and get a discrepancy in duplex or triplex, there must be something wrong with me or with the method. Now we are trying to do enough work on each method before we send it out, so that if the directions are fairly well followed uniform results will be obtained by the method. If there is an element of uncertainty in the method that cannot be covered by explicit directions, then, of course, that will be a bad method to end out. After we have decided on a method we put it into print; then we turn it over to the boys in the laboratory, with no other directions than the printing, and see what they can get out of it.

* Extracts from an address to the members of the Chemical Section of the Engineers' Society of Western Pennsylvania at Pittsburgh, Sept. 27, 1892, by C. B. Dudley, Chemist Pennsylvania Railroad Co., Altoona, Pa.

The Broadway Cable.

It is now said that the cable road up Broadway in New York city will be put in operation "about the time of the Christmas holidays." Much of the delay in this work has been due to the difficulty in getting the material, and for this the Homestead strikers are largely at fault; so the citizens of New York will have to transfer their criticisms to those irresponsible persons. But it appears that it is only on upper Broadway that the cable will be running so soon. For lower Broadway it will probably not be running before February.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The general managers of the roads west of Chicago have been considering another traffic agreement. It was drafted by Chairman Midgley of the Western Freight Association, and seems to have been intended to take the place of that which formed the basis of the Western Traffic Association. In substance it provides for giving more formal and open recognition to the scheme for diverting traffic, which was tried by the roads between Chicago and Southwestern Missouri River points, but with no satisfaction. The essential feature of the scheme is a blind pool, and Mr. Midgley proposes a board of three "disinterested arbitrators," a fund to provide for penalties, and a rule requiring a road guilty of holding on to freight which the chairman has ordered it to give up to pay 75 per cent. of the gross revenue on that freight to the road which the chairman tried to give it to. As the general managers consented to discuss this proposition for two or three days, it is to be assumed that they are not at present so pressed with freight that they are content to drop all thoughts of rate wars and the means to prevent them; or that the present run of freight, if heavy, is affording less profit than heretofore, and that therefore the necessity of preventing all unprofitable tariffs is as fully realized now as it would be in a time of light traffic. This is the chief significance of Mr. Midgley's "plan," for in principle it is no different from those which have gone before it, and the press reporters have got more comfort out of it than any one else, thus far. Railroad men must feel slightly "tired" at the first glance at it, for the opening paragraph reads:

Resolved, 1. That the parties hereto severally agree for themselves, their companies, and all agents thereof, and with each other that they will strictly maintain, in good faith, without evasion, manipulation or other devices, the rates of freight, etc.

Pledges of good faith are not needed just now, and when they are needed the only question will be as to who makes them; and unfortunately the only persons competent to make them, the presidents of the companies, will not take a very lively interest in this question until that time of necessity is upon them. This is not universally true, of course; but as long as the railroad situation is in such a condition that profitable joint action is practicable only when unanimous consent can secured, a single president who holds the sentiments of the Arkansaw fiddler with the leaky roof can neutralize the most earnest efforts of the others. Mr. Manvel has lately said that an agreement by the *principal* presidents would suffice to keep the peace; from which we infer that he thinks that a combination of the large roads could afford to ignore the weak rate-cutting lines. This is a nice recipe for a fine pudding, and we will not say that it cannot be made to work: we shall be ready to prove the pudding in the proverbial way.

The Southern Railway & Steamship Association, at its meeting in New York City this week, decided that the executive committee of the association shall hereafter be made up of the presidents instead of the traffic managers. This is in line with the growing sentiment that the rate-making power shall be lodged with only one person (below the directors) in each company. Whether such action will meet Mr. Walker's theory of separating the rate-making from the rate-maintaining power remains to be seen. Probably the Southern presidents would express this theory in another way—that a president who makes a rate should not give the traffic manager or the local freight agent secret instructions to disregard the tariff whenever he deems it necessary to do so, and then pretend to feel sorry about it. From a Chicago standpoint the Southern roads have probably been comparatively innocent of irregularities, but it appears that rate cutting has been gradually increasing in their territory, so that the harmonious relations of the roads in this Association, which for years has been the model of peaceableness, were in danger. The action taken is doubtless the best practicable. Hitherto the traffic managers have composed the rate committee of the association, and therefore, when sitting as the executive board, have passed upon their own action in the capacity of rate committee; and, as Secretary Pope says, it was only human nature that they should be lenient in their judgments of themselves, and thus judical and effective action were difficult to attain. The change from former conditions in the Southern States is doubtless due in large measure to the entrance of new competitors in the field, so that it remains to be seen how well rates can be maintained, even by the best form of agreement. One great reason why there was such perfect harmony down there for so many years was that there were not too many rail roads for the country, but the last few years have modified that condition a good deal.

The action of the Trunk line presidents on the World's Fair passenger rates, at last Wednesday's meeting is summarized thus: "On all regular trains scheduled at thirty-five hours or less between New York and Chicago, present rates will be maintained. During the Exposition, on all trains scheduled at more than thirty-five hours, 20 per cent. reduction may be made." Some of the New York daily papers say that the "business community and the public generally will be certain to regard this as a mistake," and think that the railroads ought to adopt a more "liberal policy." But if you have all the business that you can do why should you lower your prices to get more? The "business community" does not do business that way. The weaker lines may cut rates, when the World's Fair travel actually begins, to such an extent as to compel all to make further reductions; but that point cannot be settled six months in advance. As to speed, 36 hours is as short a time as the great majority of people will wish to go in; that is the schedule of the regular trains which are two nights on the road. There is little use in shortening this unless a whole night can be saved, and not much then; and to save a whole night necessitates a speed of 40 miles an hour, including stops. For such a speed the regular fares are low enough under the existing conditions. The Trunk line presidents also took action on freight rates which very likely will prove important, though there is no evidence that they have agreed to pool freight or earnings, as a sensational newspaper has it, or even to divert freight. The official and presumably frank report is that Commissioner Goddard has been authorized to vary the differental rates whenever he deems such action necessary to protect any line which is not getting a fair share of the (westbound) freight. This means that the complaints of the weaker lines will be more promptly adjusted than hitherto. That there have been many such complaints seems quite evident, though they have been kept very quiet and their importance cannot be estimated.

Mr. Stambke, chief technical adviser of the locomotive department of the Royal Prussian Ministry of Public Works, recently read a paper before the Association of German Engineers on the theory of the compound locomotive, the reasons for the use of such locomotive by the Prussian government and the results of practical trials of those engines. Mr. Stambke says that the Prussian government began the use of compound locomotives because of the inadequacy, both in capacity and economy, of the ordinary locomotives to the wants of the increase loads and traffic. He says the saving of fuel was regarded as a secondary matter. What was sought was a locomotive having an increased capacity that could be sustained when needed for unusually heavy trains or on inclines. He says that the trials of compound locomotives by the Prussian government indicate the superiority of the compound over the simple system in the following points: Greater total amount of work performed; increased economy in the use of fuels; reduction in spark throwing. One conclusion appears to have been reached on the Prussian State Railroads which is not borne out in this country. It is with reference to the exhaust nozzles, where it was found that a smaller nozzle was necessary. This is not true of the four-cylinder type, and has not proved to be necessary with the two-cylinder type in the United States.

The tenth case reported in our railroad law column this week affords an amusing illustration of the truth, often seen in all departments of law, that it is much easier to lead a horse to water than it is to compel him to drink. The Supreme Court of Georgia decides that the conductor of a train which is advertised to let off passengers at flag stations must post himself, so as to be prepared to stop at such stations, by an inspection of the passenger's ticket. This is good law, no doubt. For the passenger to hunt up the conductor and force the ticket upon him is highly absurd. Moreover, it is contrary to the habits of thousands of Americans, who hold as one of their dearest rights the privilege of keeping their tickets concealed and compelling the conductor to discover them if he can. If one's destination is a regular stopping place this is not only an enlivening mental exercise, but it is more profitable than many kinds of cheating which require more time and labor. But if a passenger bound for a flag station really desires to get off there, he will come to the melancholy conclusion that this decision does him no good at all. If the conductor fails to find him and to read his ticket he has no remedy. He can pull the bell rope if he is alert enough to take that means of stopping, and he can sue the company for damages if he is carried by. But these are not very satisfactory alternatives. Practically, he is as badly cornered as the wayfarer who wishes to drive upon a railroad crossing with his $1,000 horse and carriage without looking or listening for trains. From a legal point of view, the engineman is bound to give him good and sufficient warning, or to take the consequences; but practically the oppressed countryman can take his choice of looking out for himself or running the risk of the engine striking him, with no satisfaction but that the engine must settle with the widow for its fun. The twentieth case in the law column is also one of special interest. The Supreme Court of New York shows the fallacy of relying on the usual contract for compelling a brakeman to stop and make a scientific and critical examination of every part of a freight car before he makes use of any of its fixtures or appliances which may do him injury. It is true that in a case like this jurymen will generally lean as far to the side of the employé as the judge will permit them to; but, on the other hand, the exigencies of train work so often practically prevent a brakeman from "taking sufficient time to examine" the brake wheel, dead woods, ladders and grab irons which he encounters, that the strict construction of the contract is out of the question.

Rapid Transit in New York.

A very interesting and important step has been taken by the Rapid Transit Commissionors of the city of New York, the result of which will soon determine whether or not the present scheme for getting rapid transit in that city will be successful, or whether everything that has been done will have to be thrown over and new legislation asked for. The Board has just issued a pamphlet announcing the terms of sale of the franchise for building and operating a rapid transit railroad, and the specifications under which the work must be carried out. The franchise will be offered Dec. 29, and if it is sold we may hope that within two years the city will have a good rapid transit railroad under Broadway as far as Fourteenth street, within four years as far as the Harlem River, and within five years to the northern limits of the city. If the franchise is not sold this great enterprise will be put back again for an indefinite time, although it is possible that legislation might be secured this winter permitting some other plan to be carried out, which would bring round the same end in as short a time as the Commissioners propose. This, we say, is possible, although of course it is a speculation.

Whether or not buyers for the franchise will be found in December, we shall venture no prediction. Our opinion on this matter has been recorded more than once, but as the time for offering the franchise

at auction draws near, our zeal for prophecy wanes, and we are considerably less cock-sure of the result of the offering than we were three or four months ago.

A pretty full abstract of the specifications is given on another page. The typical drawings that have been prepared by the Commissioners we shall probably not publish, for after all they are only tentative. The Board has adopted what appears to be a very wise course of laying down general requirements both in the drawings prepared, and in the specifications, leaving to the construction company the work and cost of, and the responsibility for, the details of engineering. Therefore the specifications have been made very elastic. There are no details or dimensions of parts, no chemical or physical requirements for metal, and no effort to say how the work shall be done. The result is that the construction company can go into the open market for its engineering skill and can put all the steel mills of the country at work on its material and can use commercial shapes. This liberality of arrangement should actually result in the greatest possible economy of construction and in the least possible expenditure of time.

The very large discretion which the Board reserves to itself in the whole matter of methods of doing the work, of designs of construction and equipment, and of material, insures flexibility and should at the same time protect the city as thoroughly as if the plans and specifications had been worked out in minute detail. Whether it will or not depends of course upon the honesty and capacity of the Commissioners.

It will be noticed, also, that the Commissioners make careful provision against any job in the purchase of the franchise and the organization of the corporation which will build and work the railroad. The Commissioners will not accept any offer unless it suits them, and so they will be responsible if the franchise is sold to jobbers, speculators or obstructionists. The subscriptions to the stock will also be under the scrutiny of the Board and the actual subscribers must not be less than fifty in number. The directors, who are to number thirteen, must be actual stockholders, each one holding not less than 100 shares. It will be seen therefore that the Board will be able to control the first organization to such an extent that it will not be likely to pass into the hands of persons who would make a great job of the work, or who would hinder its progress. To be sure, in this particular also, the city will have to depend upon the honor and capacity of the Board of Commissioners, for they retain great power, even to extending the time for completion of the work. The Commissioners also reserve the power to authorize doing the work from the surface of the street at two places that are named, and also at "other special points." Upon the heads of the Commissioners, therefore, will descend the wrath of the citizens if the streets are unduly torn up or obstructed.

This is all as it should be. It is very right and proper that the Commissioners should have retained these large powers, and it is very satisfactery to know who is responsible for bad work, nuisances, dangers and damages of all sorts.

Some Remarkable Conclusions About Street Railroad Motors.

In transactions of the American Society of Civil Engineers, vol. 27, No. 3, is a paper on "Motive Power for Street Railways," by Mr. Alfred F. Sears, a Member of the Society. Some of the conclusions expressed in the paper follow.

"(1) That steam without transformation is the cheapest power that can be used where fuel can be had for reasonable cost, and is destined to be the street motor of the future. (2) That electricity is the cheapest where it can be produced by water power; and in such cases will remain, as now, a popular motor with passengers and the public. (3) That compressed air engines will be the cheapest available method and the best for dealing with all the conditions of tunnel and underground lines, where electricity is not practicable. (4) That cable roads are best for the steep street sites of hilly towns, and by saving the immense cost of grading, are the most economical, if not the only practicable, for controlling the traffic in such situations; but they are expensive, inconvenient and dangerous on level streets in business thoroughfares. These are the conclusions arrived at in seeking a power that shall produce the largest dividend and the quickest return."

The first conclusion that steam power is the cheapest is susceptible of proof to the contrary. In estimating the cost of any power for hauling street railroad trains there must be considered, not only the cost of the fuel used, but the cost of maintenance of the track, the maintenance of the motors, the cost of storage, the interest and depreciation, and, in fact, every cost that enters into the operation of the railroad that is in any way affected by the kind of motive power. To test the general statement made above it is only necessary to examine two extreme conditions of strictly street railroad traffic, omitting country lines that run but few trains a day over long tramways where there is no objection to smoke or noise. For such roads no type of motor can compete with the steam locomotive.

The two extreme conditions are, first, that of infrequent and light traffic, where one car per train will satisfy the needs of passengers, the whole equipment amounting to about 50 cars in service: second, the other extreme, requiring frequent trains of three cars each. The first is found in the suburbs of large cities, and the second in the more crowded portions. In the first case, if steam motors were used, there would be 50 steam locomotives, with all the apparatus necessary to muffle the exhaust and condense the steam. There would be valve motion, pistons, cylinders, cranks, slides, connecting-rods, and almost the same paraphernalia that is used on the ordinary steam locomotive, and some in addition. The terminal shops would have to have a capacity for 50 steam motors or locomotives, arranged in such a way that repairs could be made to them; there would need to be a machine shop, and a continual and constant inspection and means for charging the motors with steam at frequent intervals. The car driver would have to be something of an engineer, or at least be enough of a mechanic to run his engine economically, and he would have to exercise good judgment in order to get over the line without reducing his stored power to a point where the engine would become disabled. In case of a delay on the line, the motors with stored heat would be cooled off and would be practically useless, as there are no means provided on such motors for generating steam enough to get over the line with any degree of freedom. Street railroad lines of any importance are seldom without delays caused by fires or break downs. When there is a delay, a steam motor becomes less competent as the delay increases.

The weight of a steam motor is enormous compared to the weight of a grip car for cable work or an electric car for trolley work. When a steam motor gets off the track, as all street motors do, it is not a simple matter to put it back again, and the delays are greatly increased. It is noticeable that Mr. Sears, in his paper, does not give definitely the weight of the steam motor which he is advocating, but says "it will haul one or more trailers, is about that of the ordinary electric motor's weight, from five to eight tons," and in the letter from the Baldwin Locomotive Works, which Mr. Sears quotes, the weight of a compound motor is given as 18 tons. In the case of the line with light traffic which we are now considering, this great weight must be accelerated and stopped every time a stop is made. The efficiency of a steam motor where the steam is transferred from one boiler to another, and is used in comparatively small cylinders, even when compounded, is quite low. The fuel used to assist the generation of steam in the motor is anthracite, which is much more expensive than the soft coal, which could be used in the central station of either a cable or electric system. In Chicago the price is exactly 3 to 1 for the two kinds of fuel, thus involving a comparative loss of 66 per cent. in transmitting power from a central station system before the total cost of fuel would be the same as for the steam motor. There are many incidental difficulties arising from the use of steam motors which it is not necessary to mention here.

For comparison with the steam motor on light traffic take the trolley system. The cars are very light compared to the steam motor; the entire floor area of the car is available for passengers; any ordinary car driver can operate a trolley car; the number of parts and the repairs are exceedingly small when the motor is of the latest type; the money invested is small in comparison; the efficiency of the central station plant is high; delays on the line do not weaken the power of the trolley car; the motors do not have to be kept charged when out of use for a few hours, as the case is with the steam motor; power is only used by the trolley car when it is needed; the loss of power due to the acceleration and retardation of cars to take on passengers is less than one-third what it is with steam motors; the cost of maintenance of brake shoes is less with the trolley car; the cars can be accelerated and stopped in a shorter distance, thus making the trolley car safer for the public; the trolley system, including the cars and central station, require a much less initial outlay, and therefore there are less fixed charges, such as interest and depreciation. Anyone familiar with steam street motors, with their multitude of parts, and who is also familiar with recent plain and simple electric motors, will not hesitate to say that the problem of keeping 50 steam motors in repair is enough in itself to condemn it for street railroad purposes when a trolley system can be obtained. In the preceding, of course, we are referring to street car systems in the suburbs of cities where there would be required from 20 to 50 cars, running at intervals of from five to 15 minutes. As we have before said, for long lines in country districts where but few motors would be required and where there is a light traffic, steam motors might be more economical, and probably would be.

With regard to the other extreme of street railroad traffic, namely, that in the crowded parts of cities where trains of three cars each are run, all of the conditions of traffic and operation which give rise to the difficulties above mentioned for the outskirts of cities, are magnified enormously. To haul the three car trains and accelerate them when loaded with the same rate of acceleration as the cable or electric motor, would require such a comparatively large steam engine that its use would not be practicable. With the same fixed limit of speed the steam motor would have to accelerate the trains with the same rapidity as the cable in order to make the same average time over the road. The greater part of the maximum resistance of such trains is almost entirely due to acceleration, the friction of the wheels being but a small percentage of the total resistance. The dead weight of the train would be very much greater for the steam motor because of the comparatively great apparatus it would have to carry in order to have the power to accelerate the trains. This would increase the cost of operation on account of the loss of power in stopping and starting heavier trains. It would require a longer train to carry the same number of passengers with the steam motor because of the space taken up by the steam apparatus. Delays, which are frequent in crowded parts of cities, might often continue long enough to permit the dissipation of the stored power in steam motors and result in blocking the line for a long time or until horses could be procured to haul the steam motors to a point where they could be recharged. In case one of the steam motors should be derailed it would be an exceedingly difficult matter to jack it up and get it back on the track. In case any one of the many details of the steam locomotive became inoperative, the motor would have to be hauled by horses to the nearest terminal as sidetracks are not provided or permitted in the crowded parts of cities. The liability of a breakdown with a steam motor is enormously increased by reason of the great number of individual parts on which depends the action of the engine. In case of a motor being disabled there would be great delay in disconnecting the parts so horses could haul the motor in. It is questionable whether two horses could haul a steam motor and two trailers, the weight being so much greater than a cable motor and two trailers, which are now handled by two horses in case of need.

It is unnecessary to go further with this argument as any one who will stop to think of the intricate parts and the many difficulties arising from the use in crowded streets of any motor that is complicated and liable to become inefficient in case of delays, and difficult to handle in case of derailment or break-down, will conclude that a compound or condensing steam motor, with its great weight and many connections, is wholly impracticable for street work, and any steam engineer who is familiar with the low efficiency of small engines and with high efficiency of cables, where there is a crowded traffic, would readily be convinced of the greater economy of a cable system for street railroad work in the central portions of large cities. Where there are few cars, the cable is an expensive means of hauling them; but where there are many cars, it may be used with great economy.

The second conclusion, that about electricity, is undoubtedly true so far as the part relating to the popularity of the motors with the passengers and the public is concerned; and it is true that electricity is the cheapest of any known power for running street railroads where the power for running the dynamos is produced by water power. However, the author might have added with equal truthfulness, that the trolley system is the cheapest for the same service performed of all known powers for propelling street cars. Of course, this may need explanation, and perhaps should be modified by saying that the trolley system is not cheaper than horses except where there is considerable traffic, and is not cheaper than steam where there are long lines and few trains, and is probably not cheaper than cables where the traffic is exceedingly heavy, such as in the crowded portion of Chicago. But in general, for ordinary work the trolley system, by reason of the quicker time that can be made with it and from the fact that the power is not consumed when the cars are not running, and further, because of the low first cost of the central station plant and equipment, the trolley system is the

cheapest known power for propelling street cars. No better proof of this is needed than an examination of the street car systems in such cities as St. Louis, Denver, Kansas City, Cleveland, Cincinnati, Pittsburgh and Boston, where the street car facilities have been greatly increased without increasing the cost of carrying a passenger one mile. Without the trolley system these cities would not have anything like the same facilities as at present. To do the work with horses would be impossible, both in regard to power and cost. With steam motors the cost would be prohibitive. With cables the same quick time could not be made between extreme terminals, and the cost would be greatly increased.

An example of this is seen in the South Side system of Chicago. The downtown district is operated very economically per passenger-mile. The out of town district requires a 350-H. P. engine working full capacity to haul 12 trains at an average speed of about 11 miles an hour, the cable running about 14 miles an hour. The cost of operating a cable system is greatly increased as the speed increases. To the contrary, a trolley system can be operated as economically at one speed as at another. Cable roads, with their present perfection, have been known for years, and yet they are not used universally or very extensively; but with the advent of the trolley, not only were the existing horse car lines extended and the horses removed, but in some cases, like that in St. Louis, the cables which had been put in were removed and the trolly substituted. Some may dispute this when they pass their judgment upon the returns made by electric street car companies, but such a basis is not a just one as the cost in the past has been greatly augmented by reason of the experiments of electricians. The only way to judge fairly is to compare a modern trolley system with a modern cable system, each being in full operation. Mr. Sears leaves the impression that it requires a cheap source of power, such as water, to make the trolley system economical for street railroads. If this were so, how is it that such a large number of street railroads have been changed to the trolley system and such a number of new trolley roads have been built in the past few years?

The third conclusion is true, but defective, from the fact that it is impossible to show any condition of underground passenger traffic where electricity would not be a practicable motive power. The most cramped position of a motor for hauling vehicles underground is that existing in tramways in mines. The rapid introduction of electric motors for such work is sufficient proof of their practicability. Some of the largest mines in this country are using them in preference to any other scheme for hauling tram cars. The success of electric motors on the underground road in London and in mines in this country is alone enough to show that electricity is a practicable means of running trains on underground roads when compared with any steam motor.

The fourth conclusion, that cable roads are expensive and inconvenient is in general not true. It is true, where the traffic is light, as we have before explained. They are not as dangerous as steam motors, as they can be stopped in a shorter distance and can accelerate trains more rapidly, and thus can be run with a lower limit of maximum speed. The cable power is probably the safest for the public in the streets of all known means of propelling street cars, for the reason that the maximum limit of speed is fixed absolutely by the speed of the cable. The limit of speed is not left to the discretion of the driver, as the case is with the steam and electric motors. The dead weight of the train per passenger carried is less than with any other system; therefore, it requires less power to stop it, consequently it can be stopped in a shorter distance with equally good braking power. In Chicago, where there are electric, steam motor and cable lines, any one familiar with their operation would, without hesitation, say that the cable road for street traffic is the safest of the three for pedestrians and vehicles. Altogether it would be impossible for steam motors to do the work that is done by the cables in Chicago. Steam motors would fail from lack of capacity, they would be clumsy, and could not be handled with the rapidity in starting and stopping that is necessary to make the speed between terminals now made by the cable roads.

Excursion Tickets in France and Germany.

Excursion business has been more systematically developed in Europe than in America. European railroads depend upon their passenger business for a larger proportion of their income than ours can possibly obtain from that source, and the relations between the different railroad systems of European countries are so well organized that the interchange of tickets can be carried to a higher point there than here. Both of these causes have combined to enable the European railroads to adopt much more comprehensive schemes for the issue of excursion tickets than we have as yet been able to devise.

For a long time past—in fact, almost from the very beginning of their traffic history—the railroads of Europe have offered excursion tickets over specified routes at greatly reduced rates. Italy was specially enterprising in this matter, and some twenty years ago offered so large a choice of routes to the traveler that he was able to buy almost any sort of ticket that he pleased. Other countries have gradually followed the example of Italy in this respect. But a more important change, which has been fully developed only in the last few years, has made it possible for the traveler to select his own route, and obtain the same kind of reduction as if he had selected one of the routes offered by the railroad companies. There are two methods by which this is done; one applied by the roads of the German Union, the other by those of France.

The German system is the simpler. In fact, it does not greatly differ from that which is in use in the United States except in the larger choice of routes that it offers. The German railroads issue, in addition to their regular tickets, coupons for every section of line within their territory, in a special form which is to be used only as part of an excursion ticket for a continuous route ending at the point where it began. In making out such a continuous route, individual sections may be traversed more than once, but there is, or was until recently, a limit to the proportion which such double traverses might bear to the whole route. The coupons are furnished for each class—first, second or third—at about three-quarters of the regular rates. It is hardly necessary to add that they are not transferable. They are good on all trains containing cars of the class for which the ticket is issued; and the traveler can, if he pleases, take cars of a higher class for any section of the route, however short, by paying the ordinary difference in fare between the two classes. They allow a stop-over at any point of the route that may be desired. They are good for 45 days, or, when the total distance covered exceeds 1,250 miles, for 60 days. All baggage, except what can be carried in the hand, is charged extra. To facilitate the use of these tickets for excursions in more than one country, the traveler may in many cases leave the territory of the German Railroad Union at one point and re-enter it at another without forfeiting the right to treat his excursion as a continuous trip. Besides the railroads belonging to the Union, a number of steamboats and connecting railroads have been included in these arrangements, so that they now cover, with a fair degree of completeness, Germany, Austria, Switzerland, Belgium, Holland, Denmark, Sweden and Norway.

The French system is radically different in its details; and much more interesting, because it involves newer methods. The French roads do not issue coupons. The traveler intending to apply for an excursion ticket is furnished with a map of the country, on which he marks in blue pencil the route which he proposes to follow. On the basis of this application he receives a book, not containing coupons, but accurately describing his route—more like a pass than like a coupon ticket. Subsequent pages of the book contain blank spaces providing for the stamp of various ticket collectors and station masters. What the traveler has for a French excursion is not a series of coupons, but a marked route with places for entry by the railroad authorities. Whenever he wishes to stop he simply takes his book to the proper authority at the station and has a stamp placed upon it at that point. Whenever a ticket collector goes through the cars he has a right to place a mark showing what portion of the route has been already traversed; but this is rarely done, for the stamps of the stoppages furnish a sufficient control over the use of the ticket. The French tickets differ from the German in providing for a liberal baggage allowance, and there is a set of blank spaces like those for stop-overs, in which the checking of baggage can be recorded. The traveler furnished with one of these tickets thus has the means of sending his baggage on ahead to a remote point while he, himself, may make two or three intermediate stops. For interrupting the journey at the frontier the same facilities are furnished in France as in Germany. Provision is also made for breaks in the journey at points where a majority of travelers would use coaches or steamboats, but no actual arrangement for the use of steamboat coupons has as yet been made.

The rates charged for the French excursion tickets do not bear a fixed proportion to the regular prices of travel, but are arranged on a sliding scale, the mileage charge decreasing as the distance increases. Thus the price for 300 kilometres (185 miles, the smallest distance for which these tickets are issued) is 27 francs for the first class, 19 for the second and 13 for the third, or about 3, 2¼ and 1⅘ cents per mile. On the other hand, for a distance of 3,000 kilometres the rates are 200, 150 and 109 francs respectively, or little more than 2 cents a mile for the first class, 1½ for the second and 1⅛ for the third. For still longer distances the rates become still lower, increasing regularly at the rate of about 6 francs for every 200 kilometres for the first class, 5 francs for the second class and 4 francs for the third. Excursion tickets for less than 1,500 kilometres are good for 30 days; from 1,500 to 3,000 for 45 days, and above 3,000 for 60 days. Considering the accommodation and facilities furnished, the long distance excursion rates calculated on this basis are extremely low.

Arrangements are also made by which the validity of the ticket can be prolonged for a moderate payment. If the traveler desires to change his route in such a way as to shorten the journey between two points on the ticket, he is permitted to do so by applying to the station master at the initial point of such change of route. This official will correct the itinerary mark on the ticket in the manner desired. If, on the other hand, the traveler desires to lengthen his route, he has to pay for the new lines covered without allowance for the unused parts of the ticket.

The two systems are so different that it is a little hard to compare their merits directly. In matter of cheapness the German system is better for short distances, the French for long ones. On general principles of railroad economy, the possibility of adopting a sliding scale charge tells in favor of the French system, unless, indeed, the low rates for long distances should cause attempts to transfer these tickets from one passenger to another. As far as we know, there has been no complaint under this head. The French ticket is, on the whole, more convenient for the traveler; but it probably is less convenient for the companies, inasmuch as the settlement of accounts between them must occur, not through the ordinary medium of coupons, but by a calculation not unlike that connected with a freight way bill. The Germans also have the advantage in promptitude of issuing tickets. The leading stations will arrange a ticket on six hours' notice, while the French nominally require five days, although in Paris this term can readily be shortened to two. The French baggage allowance forms a great convenience to the majority of travelers and makes an appreciable difference in the expense of the journey.

The Coal Business of the Northwest.

Attention has frequently been called to the magnitude of the coal trade on the Great Lakes, and it is generally known that coal is one of the five commodities which form the bulk of the lake carrying trade. Any one who has passed through the city of Buffalo must have been impressed by the extent of the coal shipping and coal storing facilities at that point, but a still better idea of the extent of this trade can be obtained by a visit to the receiving docks at the other end of the line, as for instance at Duluth, West Superior and Milwaukee.

The principal shipping point for anthracite coal is Buffalo, as would naturally be expected. All of the railroad companies which enter the anthracite coal fields, or the allied coal companies, have docks at this point and some of them maintain large storage trestles in addition to the shipping pockets. According to the report on internal commerce of the United States for 1891, the capacity of the coal pockets at Buffalo is approximately 36,800 tons, and the daily shipping capacity is 27,500 tons. In addition to this the stocking trestles at Buffalo have a total capacity in the neighborhood of 725,000 tons. Besides the business in anthracite coal at Buffalo a large amount of both bituminous and anthracite coal is shipped from other Lake Erie ports, the principal points being Erie, Ashtabula, Fairport, Cleveland, Lorain, Huron, Sandusky and Toledo. Of these Cleveland has by far the largest coal shipping facilities, the daily capacity being in the neighborhood of 12,200 tons.

Of the receiving ports, Duluth, West Superior and Milwaukee are the largest. At Duluth and West Superior the storage capacity of the docks is in the neighborhood of 1,500,000 tons, the square feet of dock space being nearly 4,000,000. The yearly receipts at these ports amount to approximately 1,500,000 tons. This is estimated by gentlemen who are in positions to judge accurately of the volume of the business and is believed to be a conservative estimate. At these ports about 40 per cent. of the total coal received is anthracite, the remainder being Pennsylvania and Ohio bituminous coal. At Milwaukee the proportion is reversed. For the season of 1892 up to Nov. 1, the total receipts at Milwaukee were 934,000 tons, about three-fourths of this being anthracite coal and the remaining one-fourth bituminous. The storage capacity of the Milwaukee docks, which are used by shippers and not including the docks of consumers or of retail dealers is about 750,000 tons. In addition to these three ports a considerable amount of coal is received at Green Bay, Washburne, Ashland and Two Harbors.

The coal received at these various ports is distributed all over the Northwest, West and Southwest, reaching many points which would not occur to the casual observer as being commercially accessible from lake ports. One company alone reaches points well out in the Dakotas on the Northern Pacific and Great Northern systems and also points in Nebraska and Kansas, and as far west as Colorado. In many cases in Wisconsin, Iowa and Minnesota, the Pennsylvania and Ohio bituminous coal is brought directly in competition with Illinois and Iowa coal and can be delivered at prices which make it advisable to use it in preference to the poorer qualities of coal which are mined nearer home. The explanation of this is of course the low freight rates by the lakes, the ordinary rate on coal from Buffalo to Duluth, a distance of 1,000 miles, being from 30 to 35 cents a ton, while near the close of the season rates as low as 10 cents have been made. One company which

maintains docks at Duluth, West Superior, Washburne, Green Bay and Milwaukee is able to cover a particularly large territory by shipping from whichever of these ports will give the lowest combined lake and rail rate. A large amount of bituminous coal is used by some of the northwestern railroads, one road alone taking 200,000 tons annually of eastern bituminous coal. The anthracite coal is used almost entirely for household purposes and is therefore shipped to points which are not commercially accessible for eastern bituminous coals.

In handling the coal at these receiving points two general systems are in use. In one of them bulk is broken immediately on leaving the vessels, or at the edge of the dock, and in the other the coal is carried out over the dock and distributed or is carried directly to the pockets from which it is run into cars. The machinery for this unloading and distributing is in general quite simple but very effective. The simplest form consists simply of a jib crane at each hatch by means of which the buckets, holding from 1000 lbs. to one ton are hoisted and dumped immediately into coal cars of three or four tons capacity, or into small pockets and from them into the small cars. These cars are then run out on tracks over the docks and dumped either into the storage piles or into chutes leading to the box cars in which the coal is shipped. Next to this in simplicity is a species of jib crane arrangement in which the bucket is held up by the hoisting rope to the jib, which is inclined downward at the angle of about 45 deg., and which carries a small trolley, the hoisting rope acting in the first place to hoist the bucket until it reaches the trolley, and then to draw this up the jib until it is over the small car, when by a simple arrangement the catch on the bucket is tripped and the coal dumped. In another form the ways on which the trolleys run are extended over the whole depth of the dock and the bucket is thus carried to any point where the coal is desired. In this case the trolley has a catch which holds the bucket up to it until it is tripped at the dumping point. It will be seen that the last mentioned system is very similar to one of those used by the Brown Hoisting & Conveying Company. A large number of coal handling plants built by this company are to be found at various points of the lakes, and the coal handling systems built by the C. W. Hunt Co. are also used to a considerable extent.

In general, we may say that the system of handling varies greatly at different points, for the different kinds of coal, and by the various companies, and opinions differ as to which is the cheapest method of handling. On the one hand we find very simple machinery which has very little about it which can possibly get out of order and the efficiency of which depends largely on the skill of the men handling it; while on the other hand, the machinery is more complicated but is automatic in its action and it is claimed that greater speed can be obtained than is possible with the simpler systems. The general method of transmitting power from the driving engine to the hoists is by means of a line shaft, friction gears, and light wire ropes for hoisting. The docks are generally provided with a cable arrangement for moving cars both for hauling them on to the trestles at the shipping points and for moving them into position in front of the chutes at the receiving point. For loading cars from the stored piles of coal, which average from 30 to 40 ft. deep, similar arrangements to those for unloading vessels are generally employed, although a considerable number of the barrow and shovel brigade are to be seen. The Brown and similar systems are, of course, as readily used for moving coal from stock piles as for unloading ships. The most notable feature of the whole business of handling coal on a large scale is the absence of complicated machinery, which does not appear to be regarded with very great favor.

The new rule of the Long Island Railroad concerning the use of mileage tickets, which we spoke of last week, is found, according to a statement in the New York *Herald*, to produce a great deal of "indignation" among the people who travel on that road. According to the *Herald* the privilege of using these tickets for all the members of a family has been much abused, and the action of the road is also taken partly for the purpose of preventing that form of collusion between conductors and passengers, in which a passenger hands over coupons for 10 miles, but rides 50. The reporter claims that the rules still permit a passenger to take along his friends, as he can go to the ticket office and secure a dozen tickets at a time by surrendering the requisite number of coupons. The *Herald* says that the mileage books cost two cents a mile, while the regular local fares are three cents. This, if true, explains the chief cause of the trouble. It is not right to make such a large difference between the retail and the wholesale rates. With such a margin for profit the business of scalping will, as the *Herald* says, be promoted instead of hindered by the new regulations, unless the enforcement of the non-transferable clause of the ticket is very strictly carried out. If the company should also adopt the one-day limit for its tickets it would be in a much better position to prevent their illegitimate use.

The last issue of the *Chronicle* gives a table of gross earnings of railroads for the month of October. The increase over October of last year is somewhat disappointing, being but $937,665, or 1.85 per cent. Various causes for this small increase are given. Among these are blockades at various points; the fact that the month had one less working day than October of last year; that the Columbian celebrations at Chicago and New York interfered with the movement of freight, and finally that the cotton movement fell off heavily as compared with the same month of the year before. The wheat receipts at Chicago, however, were enormous, having been over 10,000,000 bushels in the month as compared with 6 000,000 last year and 1,500,000 the year before. The receipts of corn were 12,000,000 bushels compared with 2,700,000 in 1891 and 6,300,000 in 1890. For the year from Jan. 1 to Oct. 31, the receipts of cereals at Chicago were 192,550,000 bushels in 1892; 160,342,000 in 1891, and 152,914,000 in 1890. The heaviest falling off in gross receipts was on the railroads of the south and southwest.

NEW PUBLICATIONS.

Employer and Employed. Published by George H. Ellis, 141 Franklin street, Boston. 40 cents a year.

This is the title of a new periodical which appears as the organ of the Association for the Promotion of Profit Sharing. The editor is Nicholas P. Gilman, well known as a writer on this class of subjects and as the author of a book on profit sharing. As we have taken occasion to say in discussing the relations between railroads and their employés, there are a good many claims made in respect to this method of industrial reform which we regard as somewhat fallacious and some alleged principles to which we do not subscribe; but the new magazine has two important features which lead us to heartily commend it: First, it is published only once a quarter, and therefore will not be constantly under the temptation to speak when there is nothing to say; second, the editor states that the association for which he speaks desires to aid any promising method of industrial reform, whether profit sharing, earning sharing, the premium system or progressive wages. The first number has an article on the Homestead strike and one on Profit Sharing in England, including a list of firms in that country which make use of this policy.

Present Status of United States Timber Tests.

The examinations and tests of timber now in progress under the Forestry Division of the Agricultural Department, Washington, were suspended from January to July of this year from want of funds. Mr. B. E. Fernow, Chief of the Forestry Devision, asked Congress in a special bill for an appropriation of $40,000 for his work. This was wholly disallowed in the House, but the Senate added an amendment to the Department Bill giving $12,000 to this investigation. This was finally cut down in conference to $4,000, which with some additional funds from the general department appropriation constitutes the working means for the current year.

The work of testing was renewed in July at the Washington University Testing Laboratory, St. Louis, under Prof. J. B. Johnson, and the collectors are again in the field. Tests of strength have now been made on specimens from 32 trees of long-leaf pine, 4 trees of short-leaf pine, 8 trees of loblolly pine, all from Alabama; on 20 trees of white pine from Wisconsin and on 34 trees of different species of oak from Alabama.

Collections are now being made in Missouri, Arkansas, Texas and Louisiana of short-leaf and long-leaf pine.

Results have been compiled for a bulletin on the strength of long-leaf pine, commonly known in the Eastern States as Georgia pine. Eleven of the 32 trees of this species tested had been bled or boxed; that is, they had been tapped for turpentine. This timber is usually excluded entirely from use in standard specifications, but the mills regularly saw and ship it and claim that no inspector can identify it. It is thought this bulletin will settle the question of the value of this bled timber so far as its strength is concerned.

Mr. Wm. Kent, M. E., of New York, has been consulted as to the best plan to adopt in the analysis and publication of the vast mass of correlated facts brought out in these elaborate investigations, and how to compare the mechanical properties developed by the tests of strength with the physical properties found by the biologist, Mr. Philibert Roth, at Ann Arbor, Mich.

Between 5,000 and 6,000 tests of strength have now been made, and a good foundation laid for future work. One bulletin describing the scope of the proposed investigation and the methods used, with illustrations of the machines employed, has been published, and can be procured on application to Mr. B. E. Fernow, Chief of the Forestry Division, Agricultural Department, Washington, D. C. A great deal of interest in the work has been manifested, and many demands are already made for results. The first bulletin of results is delayed in order to fully mature a plan of publication which can probably be adhered to. After this has once been done the results will be given to the public more promptly.

Another special appropriation bill will probably be introduced in the next session of Congress for this work, and it is to be hoped it will fare better than its predecessors. There has been a wide demand for information concerning the strength of the famous Douglass, or Oregon fir, which is now coming into general use as far East as Chicago for bridge timbers especially, and of which Howe truss railroad bridges are now built up to 250 ft. long. No information has been obtained as yet on this subject.

If any of our readers are interested in learning more of the laws of the growth, strength, seasoning and preservation of timber, they cannot do better than try to interest their Congressmen in the work now so well started in the Forestry Bureau.

Smoke Prevention.

At the late meeting of the British Association, in Edinburgh, Mr. Sennett, of the English Navy, read a paper on smoke prevention in which he advanced the theory that combustion in a furnace cannot take place properly unless there is considerable aqueous vapor present to facilitate the union of the furnace gases with the oxygen of the air. This is a fact which has been recognized in the laboratory and which has even obtruded itself in practice very markedly in blast furnace work where hot gas, unignitable spontaneously in air, takes fire if a leaking tuyère begins to supply the needed moisture. In stationary boilers, when the natural draft has been poor, it has been quite usual to blow a jet of steam into the furnace for the purpose of inducing a current of air for admixture above the fuel with the gases evolved therefrom. Some have argued that the steam thus supplied has been an actual fuel itself, for they have judged by its effects, which have often been good. Others have gone to the other extreme, and scouted the idea of any good arising from a steam jet, by reason of the fact that any steam in a furnace goes out hotter than it comes in, and so is a loss, and they would have used an air jet preferably to steam if they could have got it. Now we are told, with great show of reason, that we must have steam in our furnace if we wish to avoid smoke, and we are referred for proof of the chemical inactivity of dried gases to the experiments of Mr. Brereton Baker, who sealed up dried powdered charcoal with both dried and moist oxygen and heated the sealed tubes in a gas flame, with the result that while the moist tubes quickly showed brilliant flashes of light from ignition, there was no combustion in the dried tubes. Mr. Sennett, in his seven conditions essential to smokeless combustion, distinctly states it is necessary to have more steam present in a furnace than is due to the hydrogen in the coal. In introducing steam to a furnace he first passes it through a superheating coil (in the uptake) and then through an air injector, so supplying moisture with air of low pressure and in large volumes to the gases evolved from the fuel on the grate. All that Mr. Sennett does has been done before, even to the use of the steam jet, when the draft has been poor, to supply air above the fuel, but no one has insisted on the necessity for the presence the of *steam* as such. It has been used because it has been more convenient than a fan or blower, but not so that it might act as a chemical reagent in promoting the combustion of other gases, itself remaining unchanged in composition. If the action of steam is to promote the union of the gases with atmospheric oxygen then the observed beneficial action is sufficiently explained to warrant an extension of the practice of employing steam. Mr. Sennett considers it largely reduces the clinker formed in a furnace. Does it promote the oxidation of the clinker-forming elements? B.

TECHNICAL.

Manufacturing and Business.

The charter of the Niagara Car Wheel Co., of Buffalo, was filed last week. Land has been bought for the works, and their erection is to be begun at once. Mr. George W. Miller, of the Buffalo Car Wheel Co., is President and Treasurer; Chester Griswold, of New York, Vice President, and James F. Chard, of the firm of Thornton & Chester, is Secretary. The property bought is situated between Clinton and Fillmore avenues, Buffalo, with a frontage on Metcalf street. The building will be of brick, about 300 × 700 ft. The capital stock of the company is $110,000.

The Fitch Excelsior Switch Co., of Jersey City, N. J., has been formed to manufacture the Fitch automatic switch. The company is capitalized at $200,000. Charles M. Fitch, South Norwalk, Conn.; Lindley Murray, 28 Seventh avenue, Brooklyn, N. Y., and John B. Conkling, Catskill, N. Y., are among the stockholders.

A large order for hydraulic projectile drawing presses has been awarded to Messrs. Watson & Stillman, of New York, by the United States Projectile Co., of Brooklyn. Orders for hydraulic presses, pumps and accumulators have been so heavy during the past year that the firm has found it necessary to operate its plant both day and night, notwithstanding increased facilities in the several departments.

C. F. Rydberg, formerly with the Pullman Car Co., has accepted the superintendency of the St. Charles Car Co., of St. Charles, Mo.

The bolt works of the Indiana Iron Co., at Muncie, Ind., will be started during November with 150 men, and that number will probably be doubled within three months.

Charles W. McCorkle has been elected Secretary and General Manager of the Northwestern Equipment Co., 1023 Monadnock Building, Chicago.

The B. F. Sturtevant Co., of Boston, has received orders for supplying its system of heating to the large new foundries of the National Malleable Casting Co., Chicago, and the Carnegie Steel Co. Each of these

plants will require a blower over 20 ft. in height. The foundries will also be supplied with the Sturtevant cupola blowers, to be driven by direct connected Sturtevant electric motors.

The Cambridge Corrugating Co., of Cambridge, O., recently organized, has its plant in operation and will manufacture steel and iron roofing, spouting, mixed paints and metal products.

A surface cattleguard has been invented by James Walton and G. D. Hutchinson, General Foreman of the Chicago, Ft. Madison & Des Moines road. Two of these guards have been in use on the road, and others have been ordered.

The Michigan-Peninsular Car Co. has declared a dividend of 2 per cent. on its preferred stock, payable Dec. 1, and resolved to make dividend periods semi-annual on the common stock, in March and September. The net earnings for the quarter ending Nov. 30, 15 days approximated, are stated to be $227,000, which, after paying interest on bonds and dividends upon preferred stock, leaves $102,000 applicable to dividends on common stock, which is at the rate of more than 20 per cent. per annum.

Iron and Steel.

The Norristown Steel Co. has elected these officers President, Joseph H. Hampton; Vice-President and General Manager, George J. Humbert; Treasurer, C. C. Highley; Secretary, E. M. Daniels.

Details of the reorganization of the Carnegie Steel Co., Limited, not heretofore published, were given in papers filed for record at Pittsburgh last week. The capital stock is $25,000,000, and is divided among 23 holders. Of these all except four are citizens of Pittsburgh and Allegheny. The record shows that of the original capital of $5,000,000 in Carnegie Bros. & Co., Andrew Carnegie held $2,766,666. Henry Phipps, Jr., $550,000; H. C. Frick, $550,000, and George Lauder, $200,000. In the reorganization Mr. Carnegie holds stock amounting to $13,833,333, or $1,000,000 more than the controlling interest. The others are as follows: Henry Phipps, Jr., $2,750,000; H. C. Frick, $2,750,000; G. Lander, $1,000,000; W. H. Singer, $500,000; H. M. Curry, $500,000, H. W. Borntraeger, $500,000, and J. G. A. Leishman, $500,000. The officers of the new company are: H. C. Frick, Chairman; H. M. Curry, Treasurer, and F. T. F. Lovejoy, Secretary. The works included in the reorganization are the Edgar Thomson, Homestead, Duquesne, upper and lower Union Mills, the Lucy Furnaces, Keystone Bridge Works, Beaver Falls Mills, the Scotia Ore Mines, the Larimer Coke Works and the Youghiogheny Coke Works.

The two blast furnaces which the Carnegie Steel Co. intends to erect at Duquesne in connection with the Duquesne Steel Works will be the largest in the world. They will have three hot-blast stoves each. For some time the Carnegie Steel Co. has had to buy considerable pig iron for the Duquesne Works, and these furnaces are to obviate this necessity. Work will probably not be begun before spring.

New Stations and Shops.

The Lobdell Car Wheel Co., of Wilmington, Del., has placed the contract for its new machine shop with the Berlin Iron Bridge Co., of East Berlin, Conn. The building will be 67 ft. in width, divided into a central portion 25 ft. in width, with a wing on each side 21 ft. in width. The central portion is controlled by a 15 ton traveling crane. The building will be 151 ft. long, the entire framework being of iron, the side walls being of brick.

The Lehigh Valley is building a brick roundhouse with 18 stalls at Manchester, N. Y., on the Buffalo extension. A frame engine-house is being erected at Batavia. The trainshed at Rochester, 300 ft. long, is being finished. Logie & Bolton, of Buffalo, have a contract for building the retail coal pockets in Rochester. There will be 30 pockets of 100 tons capacity each. The same firm has the contract for driving 400 piles for the foundation of the new freight house at Rochester, which will be 100 × 300 ft.

The plans for the Spokane shops of the Great Northern have been completed and contractors are now preparing their estimates for the work. The plant will be located on the eastern border of the city, and will include the following structures: Machine shop, 160 × 150 ft.; car shop, 90 × 300 ft.; paint shop, 60 × 150 ft., and office and storehouse, 40 × 100 ft. Contracts will be awarded in a few days, and the work will be pushed as fast as the weather will permit.

A contract has just been awarded by the Northern Pacific to the Western Bridge Co., of Spokane, for the construction of a brick freight house 60 × 360 ft. in Spokane, Wash.

The King Bridge Co., of Cleveland, has the contract for the iron work for the new building for the Brown-Bonnell Iron Co., of Youngstown. The foundations for the new structure are nearly completed, and the work of erecting the buildings will begin as soon as possible.

The Niagara Falls Tunnel.

The Cataract Construction Co., which controls the water power privileges at Niagara Falls, has determined upon the rates per horse power to be charged companies or individuals using power. About 3,000 H. P. for the Niagara Falls Paper Co is furnished at the extremely low price of $8 a year for 24 hour horse power. The ordinary rates for power are to be $10 per horse power for 5,000 H. P. or over, $10.50 for $4,500 H. P., $11 for 4,000 H. P., and so on down to $21 for 300 H. P.

An extension of the great tunnel 500 ft. long has been determined on and the contract let. The extension, which is designed to bring into use for power purposes the land along the river near the Schlosser dock, will enter the eastern terminus of the present tunnel, taking a southeasterly direction. It is to be completed on Feb. 1 next. The connection between the wheel pit and the main tunnel is nearly completed.

Twin-Screw Steamer for Long Island Sound.

The New York & New England has engaged A. Cary Smith, of New York, to design and superintend the construction of a large twin-screw passenger steamer for Long Island Sound. Mr. Smith designed the yacht Priscilla and the screw Sound steamer Richard Peck.

Panama Canal.

M. Ricard, the French Minister of Justice, has decided to prosecute the directors of the Panama Canal for frauds. If this is carried out it will be one of the most remarkable criminal trials in all history. Of course, M. de Lesseps will be one of those prosecuted, and among other famous men included with the defendants will be M. Eiffel. The contractors are to be prosecuted as accomplices.

Armor Plate.

Last Tuesday an armor plate trial was to have been made on the Russian proving grounds near St. Petersburg. A Harvey plate was to have been tried. This was manufactured under the Harvey process by Vickers in England.

Car Lighting.

We have announced in recent issues a large order given by the Pennsylvania Railroad for lighting equipment for passenger cars on the Frost Dry Carburetter system. We think it is an undoubted fact that this system has been finally adopted as standard for the Pennsylvania proper and the Pennsylvania lines west of Pittsburgh. A new carburetter will be used in future equipment, being made square instead of cylindrical.

The Altoona Eastbound Yard.

The new gravity yard of the Pennsylvania Railroad at Altoona was described and illustrated in our issue of July 29. The reader will probably remember that it is a receiving and classification yard for eastbound freight. It is quite a departure from ordinary practice in several respects, and therefore is of unusual interest. The efficiency of the arrangement has now been demonstrated by a good many months' use. As many as 2,000 cars a day are handled through this yard, and the average is probably 1,800. The switches in the classification yard are worked by compressed air, the valves admitting the air to one side or the other of the pistons being actuated by electricity, and these switches are all operated by one man in a tower at the upper end of the classification yard. The cars are started out of the receiving yard by a poling engine, but run down and through the classification yard by gravity, and are handled with great expedition. They are ridden by brakemen, and thus the necessity for a chain drag as used in the English gravity yards, or other devices for stopping the cars does not arise. The progress of any car or group of cars through the yard is indicated on a board before the operator in the tower so that he can see at all times when a switch has been cleared and is free to be moved for a following car. The yard is brilliantly lighted by arc lamps on high poles. The switches are provided with ground lamps showing red and white, and these are lighted by incandescent electric lamps. The switches are worked from the tower to a distance of nearly 2,000 feet.

The Columbia River Bridge of the Great Northern.

The crossing of the Columbia River by the Pacific extension of the Great Northern is at a point 9½ miles south of the town of Wenatchee, Wash., near the junction of the river of the same name with the Columbia River. The bridge will consist of two spans. The east span will be a deck truss of 250 ft. and the main or channel span will be 416½ ft. in length. The east end of the bridge is to be supported in the solid basaltic rock bank of the river without masonry. The pier between the spans is a rock island in the river, requiring very little masonry, on which will stand four legs of a tower 64 ft. in height. The west end of the long span is to stand on a rocker bent tower also 64 ft. high, standing on the natural rock. The truss gives a clear width of 23 ft. The long span consists of 14 panels with broken top chord, the highest part being 80 ft. The superstructure is in the hands of the Edge Moor Bridge Co. The foundations are prepared by the railroad company. The site of the crossing is very favorable, being at the narrowest point in the river for many miles. The general width of the river is from 1,000 to 1,500 ft. The approaches to the river are easy, allowing sufficient height to be attained to permit the passage of steamboats without the use of a drawbridge.

Painting by Power.

A novel method of painting is now used at the Agricultural Building for the World's Fair, by which the paint is sprayed upon the surface to be painted. The pump used for this work is a rotary made by the Turner Machine Co., New York. This is similar to other rotary pumps and engines with the exception that there are no springs to force the pistons or bearing surfaces out, but the diagonally opposite pistons, of which there are four, are rigidly connected. The shaft is of course eccentric with the cylinder casing, and the piston which is on the side where the radius is decreasing in length forces out the opposite piston and keeps it in contact with the cylinder. The latter is necessarily not a true circle, but is bored out on one half of its circumference so that the diameter measured across the shaft is of constant length. No packing is used, the bearing surfaces at the ends of the pistons being pieces of half-round steel wire which can be readily renewed when necessary. This principle was first applied to pumps for water and air, was then used for spraying fuel oil into furnaces, and is now spraying paint in the same manner. A stream of paint about three-eighths inch in diameter is supplied to the pump at the air inlet and is discharged as fine spray through a hose and flat nozzle. In a test recently, three men with the pump painted about nine times as much surface as four men with brushes in the same time.

What Chemical Limits Mean.

Dr. C. B. Dudley recently read before the chemical section of the Engineers' Society of Western Pennsylvania a paper on "Causes of Discrepancy in Chemical Analysis." In the discussion which followed Mr. A. S. Ford said: "Take rails for example; the specifications say .45; your inspectors reject .44; their orders are to reject anything below .45. Now, you can't come closer than two points with the color test. The rails are rejected on one point, yet the carbon might have been .46 instead of .44 per cent." To this Dr. Dudley replied: "We give in all our specifications a pattern; something we desire. This is simply to stimulate growth; to spur the manufacturer to do a little better than he is doing. We give a pattern, and then we give a limit some distance below the pattern, and accept the material down to that lower limit. In a number of cases, also, we give an upper limit, beyond which we will not accept the material. Now here is the puzzle: The manufacturers aim right square at the lower limit, and the uncertainties of the process are so great that they tumble down about half the time. Let me give you a case: Along in the early days we put the lower limit for carbon in spiral springs at .90 per cent. A great many men said we were making a serious mistake in putting the carbon so high; they wanted .75 per cent. as a maximum—.60 per cent. was high enough, they said. Without going into ancient history, I will say that we had about a three years' struggle to get the manufacturers up to .90 per cent. They did not allow any margin at all for the burning out of the carbon in the process of manufacture, and bought their steel on specifications that it should not go below .9 carbon. We rejected hundreds and hundreds of springs simply because the manufacturer aimed at something that would just squeeze through. We think there is no difficulty whatever in filling Pennsylvania Railroad specifications if you will aim at the proper point in the manufacturing; for there is no specification that we know of that has not been made after careful consultation with good manufacturers, and the limits of error necessary, for the uncertainties of commercial work have been allowed for in the limits of the specification. If a manufacturer gets an order from the Pennsylvania Railroad, he will never have a rejection of the material if he will aim between the two limits of the specification; not at the lower limit, so as to just squeeze through, but at the mean between the two."

A French Opinion on Compound Locomotives.

In discussing compound locomotives at the International Railroad Congress, at St. Petersburg, a few months ago, Messrs. Parent and Concanargeres, of the State and the Paris-Lyons-Mediterranean roads respectively, said substantially that the advantages claimed for the compound system had not yet been demonstrated to the satisfaction of all railroad engineers. It was true on the other hand that those in favor of compound locomotives were more numerous than those opposed to them, and the number of compound locomotives in use has been increased in less than three years from about 680 to 1,858. The two-cylinder compound locomotives increased in number from 522 to 1,371; the three-cylinder compounds from 90 to 108, and the four-cylinder engines from 50 to 379. These appreciable increases are to be ascribed largely to the higher steam pressures used. The two-cylinder compound locomotive has met with most favor; but, on the whole, the greatest improvements have been made with the four-cylinder engine, brought about by the attention given to the subject in the United States. The results of some long-continued tests have practically shown that in countries where coal is cheap the changing of ordinary into compound locomotives, or the building, at the outset, of compound locomotives, is not likely to lead to any advantage; where coal, however, is dear, the building of new compounds, and the rebuilding of old, single engines to work on the compound system, and the adoption of higher steam pressures are advisable. With the two-cylinder compounds, at least, it has been found that there is no increase in cost for oil, maintenance, etc., as compared with ordinary locomotives.

Cut vs. Wire Nails.

For some time the sales of wire nails have been encroaching on those of cut nails and now some of the leading nail cutters have issued a notice that, commencing on the 30th inst., there will be a public test of the holding power of the two types of nails at the United States Arsenal, Watertown, Mass., upon the government testing machine, under the control and supervision of the commanding officer of the arsenal. The object of

the tests, as stated, is to ascertain the comparative holding power of cut and wire nails of equal length and weights, when driven as in actual use, into the common building material of the country, say spruce wood. It is proposed to pull 10 nails of each size alternately, thus testing the nails in pairs until the list is exhausted. It is also proposed to test barbed wire nails in sufficient numbers to ascertain their comparative merits. The cut nail men specify some 38 different styles and sizes of cut nails, varying in length from 1¼ to 6 in., and say they have also selected the same number of samples of wire and barbed nails, inviting the wire nail men to inspect the selection, and if any are, for any reason, objectionable, to substitute others of the same dimensions for them. These experiments will authoritatively settle the holding power of the two styles of nails, but while the 100-lb. keg of wire nails sells from mills at $1.55, and the keg of cut nails at $1.60, the sale of wire nails will probably increase.

Sub-Division of Power.

When the great Spreckel's sugar refinery was built some four years ago, not only was the sub-division of power so completely carried out as to involve over 60 engines distributed on every floor of the enormous building, and practically doing away with shafting and belts altogether, but high-speed engines were selected, and most of them set without foundations. Non-compound engines were employed, from the fact that the various processes utilized all the exhaust steam which could be made. This refinery has since passed into the ownership of the American Sugar Refining Co., and further enlargements are now in progress, and an order has just been placed for five more Westinghouse "Standard" engines, four of 100-horse power and one of 75-horse power, making 68 engines now operating in this refinery. An interesting feature developed in this establishment has been in the matter of repairs and stoppages. The master mechanic keeps on hand a set of duplicate parts for each size of engine, and covering such parts of the engine as are most subjected to accident or wear. When a part is worn out, or an accident occurs, he gives the spare part to the engineer in charge of that particular department and it is at once put in place, the old part being returned to the shop and overhauled at leisure. In this manner there is no delay and the maintenance account is reduced to practically nothing. A similar sub divided plant, involving 42 engines, was installed at the print works of the Dunnell Manufacturing Co., Pawtucket, R. I., and its chief engineer reports that the total repair bill for the first year of continuous operation was less than three dollars.

A New Plan for a Simplon Tunnel.

A new project has been brought forward for piercing the Simplon. When these projects reach a hundred we shall make a mark. This new one is based on the use of the Abt rack railroad and involves a tunnel eight kilometres long, at an altitude of 150 metres, one half of which will be on Italian territory. The entire line from Brigue, the end of the Swiss railroad, to Domo Dossola, the end of the Italian system, will have a development of 54 kilometres, 34 of which will be rack railroad. The estimated cost of the enterprise is 4,000,000 francs. The projectors say that they could handle on this railroad 125,000 passengers and 300,000 tons of freight. What traffic will then remain for the existing tunnels at St. Gothard and Mont Cenis?—*Journal des Transports.*

THE SCRAP HEAP.

Notes.

Herbert Goodwin, engineer of the freight train which ran into a passenger train at West Cambridge, Mass., in September, has been brought to trial and is now under $5,000 bonds.

The New York, Lake Erie & Western has increased the pay of some of the telegraph operators on the New York, Pennsylvania & Ohio division. A similar increase was made in the Chicago & Erie not long ago.

One of Chief Engineer Brown's assistants is making a trip with a special train throughout the lines of the Pennsylvania road for the purpose of measuring the width, height and and length of all tunnels, bridges, etc., the special object of the expedition being to revise the table of clearances for use in loading bulky freight to pass over the road.

A train of the Western & Atlantic was attacked at Adairsville, Ga., on the night of Nov. 12 by a party of highwaymen who attempted to rob the baggage car. The trainmen were armed, however, and after a sharp fight, during which the train was stopped, the robbers were repulsed, one of them being wounded. A train of the Atchison, Topeka & Santa Fé was stopped on the morning of Nov. 9 near Guthrie, Oklahoma, and the express car robbed.

There is a strong movement at New Orleans to establish United States Mail service on the street cars. During the recent strike of the street railroad employés in that city the delivery of mails was much interfered with, as a large number of the carriers are in the habit of using the street cars to facilitate their work. It will be remembered that a regular line of mail cars is in operation on an electric railroad in St. Louis. A cable railroad in New York City has cars lettered "U. S. Mail."

The great strike in New Orleans which was participated in by nearly all of the artisans and skilled laborers in the city, some 15,000 in all, was finally joined by the railroad freight handlers on Nov. 9, and all the roads, except the Southern Pacific, suffered to some extent, though the general stagnation of business was such that the railroads were in a position to put up with the inconvenience. The Strike finally collapsed on Nov. 11, the Governor of the State having ordered the militia out to protect non-union men.

World's Fair Notes.

The terminal railroad station building is beginning to assume shape, and a considerable number of the storage tracks and depot tracks are laid.

The painting of the buildings is progressing rapidly by the use of the Turner system of spraying paint. It is said that with this device the same number of men can cover about twelve times as much surface as by hand painting and the machinery works equally well with oil paints or kalsomine.

Along the line of the Illinois Central there are further evidences of preparation for the Fair. The Hall Signal Co. has a considerable amount of its signaling apparatus in place and more of it on the ground. Work is progressing on the elevated tracks, and one of them is being used by southbound through trains. The bridges and street crossings are, however, unfinished, and, awaiting the completion of the abutments, the tracks cross the streets on trestles. At Twelfth street the new depot is beginning to show above the ground, a considerable number of the pillars are in place, and foundations are finished over a large portion of the area to be covered.

Some of the buildings at Jackson Park begin to have an inhabited appearance, especially Machinery Hall. The exterior of this building has a very unfinished appearance as yet, but inside the work is apparently more advanced than in other departments. Some of the boilers which are to furnish motive power as well as being exhibits are erected and under steam, although not under cover, and a long line of water tube boilers is in various stages of erection. The foundations are completed or well advanced for a considerable number of engines, and a few of these are erected and in operation. Some of the larger exhibits which are to be used during and after the installation of exhibits, such as a Yale & Towne traveling crane and large Worthington pumps, have arrived and will shortly be erected. In the Transportation Annex the tracks are laid and the space generally floored over. The transfer pit, in which the large transfer table built by the Industrial Works is to be placed, is nearly finished, and the transfer table itself is on the ground.

At the request of the World's Fair authorities, Mr. Clement E. Stretton, of Leicester, England, has forwarded an interesting collection of English tramway and railroad rails, including specimens of almost every type used from as far back as 1767. Among the number are sections of cast iron rail laid in Wales in 1767, upon which locomotives ran in 1804; sections of cast iron edge rail laid in 1789 in Loughborough; sections of cast iron edge rail laid in 1793, and used continuously for 100 years, presented by the Duke of Rutland; wrought iron rail laid in cast iron chairs at Swannington in 1820; specimen of Liverpool & Manchester Railway rail, five yards long, with six chairs, laid in 1829, constituting a part of the road on which the test was made when Stephenson's engine, "The Rocket," proved victorious; a flat-foot rail and chairs, laid by Earl Stamford in 1835; a high lap-joint rail and chairs patented in 1816 and laid in 1838 by Losh and Stephenson, and a double-headed rail and chairs of 1837. Mr. Stretton has also sent to Chicago about 100 photographs of English locomotive engines of dates between the years 1803 and 1892. Mr. Stretton is known to many of our readers as the author of "Safe Railway Working" and as a writer on railroad matters.

Testimonial to the New South Wales Railway Commissioners.

When giving an account of the false and unfounded charges brought against the New South Wales Railway Commissioners and against Mr. E. M. G. Eddy in particular, we expressed the conviction that the inhabitants of the Colony would take the opportunity of the next election to exonerate themselves from all association with the authors of the charges. But we are glad to see that they have not waited for an election before displaying their sympathy with Mr. Eddy and his colleagues. A great wrong has been done to honorable public servants, and no sooner were their characters cleared than the colonists set to work to organize a demonstration, which both by its magnitude and importance, should show on which side the great mass of respectable citizens were ranged. On Monday, Sept. 13, an enthusiastic meeting was assembled, and in presence of many of the leading men of New South Wales an address of sympathy and congratulation, bearing 20,000 signatures, was presented to Mr. Eddy by the Mayor of Sydney. A number of speeches were made, all laudatory of the action of the Railway Commission, and in reply Mr. Eddy reviewed the progress that had been made under his management.—*The Engineer.*

Railroad Rates in Kansas.

Fears have been expressed that the new State government and the legislature would at once inaugurate a war on the railroad and other corporations. Governor-elect Lewelling, in a statement regarding the probable passage of a maximum freight-rate bill by the Legislature, said: "They will certainly enact some legislation looking to the control of freight rates. Personally I am inclined to favor a commission with power to fix rates, a commission composed of honest, capable, and conservative men who are competent to ascertain the needs of the people and so adjust rates as will best serve all the interests of the State."

The Inland Waterways of France.

The British Consul as Rouen, in a recent report, says that France is greatly in advance of England in the movement for developing inland navigation. More than £60,000,000 has been expended by the State in France for the enlargement and improvement of its inland waterways within the present century. The perfecting of the vast network of canals and "rivières canalisées" has been the work of the present Republic, which has spent £40,000,000 on the work. France possesses a comparatively perfect system of inland waterways, the total length of which now reaches 7,456 miles. These waterways are as free to the use of all as the roads of the country, the last vestige of canal dues having been swept away in 1880.

The Thirsk Accident.

The Marquis of Tweeddale, the chairman of the North British Railway, has given the following account of the dreadful accident on Nov. 2, which has broken the long record of immunity from great disasters enjoyed by the North-Eastern Company. Lord Tweeddale said:

"At the time of the accident the express in which I was a passenger was traveling at the rate of nearly 60 miles an hour. Fortunately the goods train had at the time begun to move onward, and this, of course, somewhat lessened the violence of the shock. I was asleep in the Pullman car. Among the other passengers in the same saloon were the Marquis of Huntly, General Lambton and Mr. Kynoch, one of the directors of the Highland Railway. None of us were injured, although we all got a great fright and a severe shaking. The engine and tender of the express were smashed, also the carriage next to them, but the body of the Pullman carriage stood the shock, although its forward end was knocked off. . . . The carriage behind the Pullman was injured. There was no fog at the time of the accident."

Signalman Holmes says that, after being on duty in his cabin for 12 hours he returned home at seven o'clock on Tuesday morning and retired to rest. His youngest child, who was not well, was placed in bed with him. Just before noon the child was seized with a convulsive fit. He got up and went for a doctor, and when he returned his baby was dead. Later on he applied to his superior officer, the stationmaster at Otterington, to be excused from duty, saying that he was not fit to go into the signal-box that night. The stationmaster replied that he would see what he could do, but subsequently said that he could not find a "sub." Holmes replied that in that event he would do his best, though he repeated that he did not feel fit for work. He went on duty at eight o'clock, two hours after his proper time. He remembers the first section of the express passing his cabin at 3:38, up to which time he had not felt at all fatigued.

"After that time," he continued, "my mind became confused. Nothing seemed properly clear. I accepted the goods train in the ordinary way, but after that I took no more notice. I omitted to give the necessary signal to send the goods train on; indeed, I must have dropped asleep and the goods train remained stationary. The signalman at the next box woke me up by giving me notice to be ready for the express. I was confused in waking up, and, forgetting about the goods train, signaled the line clear for the express. At the same time the goods train, seeing the signal, moved forward, and the express, having the line signaled all clear, came rushing on and dashed into the rear of the goods train. As soon as I heard the express passing away from the other signal signal station I knew what was up; it was too late, and all I could do was to wait for the crash."

While giving this narrative to a correspondent of a news agency Holmes appeared to be much affected. He rested his head upon his hand and frequently gave way to tears. He went on to add, as a curious coincidence, that when he was at home last Sunday the circumstances of the Taunton accident two years ago on the Great Western line—where a question of signaling arose—came into his mind and haunted him throughout the day.

It should be stated, in justice to the railway company, that while their officials admit that while the man applied for relief in the afternoon of Tuesday, they consider that he subsequently withdrew the application. They point out that he could have lost but little rest on Tuesday, as the child was not taken ill till mid-day, and that he had left work at six o'clock that morning. They also assert that he applied for leave of absence simply to keep his wife company owing to their distressing bereavement, and that, when the difficulty of finding a substitute was pointed out to him, he replied that it did not matter about his getting off, as a female friend had offered to keep his wife company.—*The Railway News, London.*

Dynamite Explosion.

Last Saturday an explosion of dynamite occurred near the main wheel pit of the Cataract Construction Co.'s tunnel at Niagara Falls. The magazine contained about 166 lbs. of high explosives. One man was killed and a number injured.

Where is Dr. Wellington Adams?

One Herr Kosstetter recently described before the Austrian Society of Engineers an electric locomotive designed by him, which is expected to make 123 miles an hour, and it is said that a railroad is to be built along the banks of the Danube from Vienna to Budapest on which this marvelous machine will run.

Sawdust Bricks.

Sawdust bricks for building purposes are spoken of in one of our German exchanges. The sawdust is dried and screened to remove the coarser particles, and is then mixed with cement, lime and sand in the following proportions: One part cement, two parts lime, five parts sharp sand and two parts sawdust. The sawdust is first mixed dry with the cement and sand. The final mixture is pressed into blocks, which are said to be cheap and serviceable.

The High Nile.

In Upper Egypt the Nile flood has receded sufficiently to permit a partial sowing of cereals. In Lower Egypt the river continues falling, and the outlook is now fairly reassuring. Some considerable quantities of cotton and maize have been destroyed by infiltration through the river banks on the Damietta branch. It has been only the incessant watchfulness on the part of the government officials that has saved the country from a serious disaster from this year's abnormal flood. Over a hundred thousand men have been employed on forced labor in watching and repairing the banks.

Luminous Photographs.

Luminous photographs have been prepared by coating cardboard with a variety of luminous paint, and then mounting on this cardboard the photograph which has been previously made translucent by treatment with oil. Photographs, so prepared, when exposed to sun or magnesium light will, it is said, appear luminous in the dark for several hours.

Car Shop Fires.

The car shops of the Richmond, Fredericksburg & Potomac, at Richmond, were burned Nov. 14. The woodworking machinery and three loaded and seven freight cars were destroyed. The loss is $20,000, insured.

A fire originating in the color room of the paint shops of the Baltimore & Ohio in Glenwood, near Pittsburgh, destroyed two new passenger cars and the roof of the paint shop. The loss is $20,000.

More Rain-Making.

Uncle Jerry Rusk does not propose to go out of power without trying once more to compel the heavens. Another expedition has gone to Texas with a vast supply of explosives to renew the absurd experiments in rain-making, about which so many lies were told last summer. Rainmaker General Dyrenforth and two other special agents of the Agricultural Department and a corps of six assistants will conduct the experiments, and we are sorry to see that certain officers and soldiers of the United States Army will have to help in the matter.

The Conneaut Ore Harbor.

A new ore harbor has just been opened at Conneaut, O, where a channel has been dredged 118 ft. deep and 120 ft. wide for 2,000 ft. On the dock just completed there are three of the Brown Hoisting & Conveying

Co.'s ore hoists and two traveling steam derricks put up by the Excelsior Iron Works Co., both of Cleveland. These docks are connected with Pittsburgh by the Pittsburgh, Shenango & Lake Erie, to Butler, Pa., from which point the ore reaches Pittsburgh over the Pittsburgh & Western.

The first cargo of ore was unloaded there last week and several more cargoes are consigned to the docks this season. Arrangements have been made with furnace owners and ore shippers which it is hoped will insure a considerable portion of next season's lake business. About $250,000 have been expended on the dock equipment. Col. S. B. Dick and Mr. C. A. Huidekoper are said to be the leading capitalists connected with the enterprise. J. T. Blair of Greenville, Pa., is superintendent of the railroad, and Capt. E. Day, formerly Superintendent of the N. Y., P. & O. docks at Cleveland, has charge of the dock.

Bridges Wrecked by High Water.

Considerable damage was done to temporary bridge structures along the Raritan River in the vicinity of New Brunswick, N. J., by the heavy rains of Tuesday and Wednesday of this week. About 500 ft. of the temporary bridge of the Pennsylvania at New Brunswick, where a new bridge is being erected, was carried down the river and demolished about 75 ft. of the temporary bridge at Albany street, which is being used during the construction of the new stone arch. The wreckage from these two bridges struck another temporary railroad bridge, building south of the new stone arch.

Mining in Ontario.

The first annual report of the Bureau of Mines for the Province of Ontario has just been issued. What strikes one most forcibly in hastily glancing over the figures in the volume is the insignificant output of some of the most important minerals in the Province and the comparatively large sums representing the value of production under other heads. For instance, the output of gold ore was placed at 2,000 tons, and of iron at 200. On the other hand, lime to the value of $300,000 was produced; brick and building stone represented a million dollars each; salt productions were valued at $157,000; drain and sewer tile at $360,000; petroleum at $1,250,000, and wages alone paid in mining nickel amounted to $322,000.

Patent Preventer of Running Away.

One more patent fee has been deposited at Washington, as will be seen by the dispatch quoted below, and the rest of us will have a trifle less to pay toward reducing the government debt.

Special to the St. Louis "Republic": *Alton, Ill. Oct.* 25—Henry Meyer is the inventor of a switch protection which provides for a cage over the switchstand. Into this cage the switchman must go in order to unlock the switch. The instant he throws the switch to the side track the cage closes and makes him a prisoner. He can only get out by throwing the switch back to the main track. An open switch, in case of accident, will thus hold the party to blame where he can be found. A caveat has been filed and patent applied for.

Mr. Meyer's main object is laudable. If he would only devise a cage for locomotives and cabooses, so that conductors and enginemen who cause collisions would be "held where they could be found," he could frequently save the officers of the law considerable trouble. But if he goes to charging a fat royalty for a switchman's detainer we advise intending purchasers to kick. They can buy any quantity of second-hand cages from the New York, New Haven & Hartford road, and we feel safe in saying that the price will be low, as the cages have been exposed to the suns and winds of several summers and winters in a gravel pit out near Saugatuck or Cos Cob or somewhere along there.

Railroad Taxes in New Jersey.

The State Board of Assessors has announced the assessment on railroad and canal property in New Jersey for the current year. The total value of all the property under this head is $216,249,782. The state tax is $1,081,248, and the local tax $388,529. The total valuation this year is $7,547,314 larger than last year.

Locomotive Boiler Explosion at Schuylkill Haven.

Six men were killed by the explosion of the boiler of locomotive No. 563 of the Philadelphia & Reading Railroad near Schuylkill Haven, Pa., at about 2 o'clock on the morning of Nov. 14. The killed were all employés, but some of them were men who did not belong on the engine which exploded but were riding upon it to their homes. It is said that the train, a freight, had just come to a standstill from lack of steam, and that the blower had been put on. The engine was in the shop only three weeks ago. A press report says: "On the crown sheet is unmistakable evidence that the explosion was caused by low water, as the iron is burned a deep blue color, and the marks show just how high the water was."

Close of the New York Canals.

Superintendent Hannan, of the New York State Department of Public Works, has announced that the Champlain, Black River, Oswego and Cayuga and Seneca canals will be closed on Wednesday, Nov. 30, at midnight, and the Erie Canal on Monday, Dec. 5, at midnight, unless sooner closed by ice. The date named for closing the Erie is five days later than usual.

Pennsylvania Improvements at Elizabeth.

Rapid progress has been made during the past week on the Pennsylvania elevation at Elizabeth, N. J. About 200 ft. of trestle has been erected south of the Pearl street crossing and the excavation for one abutment of the bridge across that street is made. Between Murray and West Grand streets the trestle is erected and the stringers are being placed. At the Broad street crossing the pier between the Central of New Jersey tracks is completed and the excavation is made for the north abutment of the Broad street arches. The protest of the Morris avenue property owners, together with their plan for the crossing was submitted to the City Council this week, and referred to a committee to report in December.

The St. Mary's Falls Canal.

Gen. O. M. Poe's monthly report shows that in October 1,135 steamers, 395 sail craft and 71 ratts and unregistered craft passed through the canal. The registered tonnage aggregated 1,367,351 tons, as against 1,101,642 tons for October, 1891. The freight tonnage for the month was 1,432,533 tons, of which 419,220 tons was west bound. Iron ore contributed less than 42 per cent. to this tonnage. Of the greatly increased traffic of this season General Poe says:

"The freight tonnage this season, to Oct. 31, already exceeds by 1,215,491 tons that of the greatest season in the history of the canal, having reached a total of 10,256,704 net tons, and, with more than a full month of navigation remaining, we reasonably expect to reach a total of 11,000,000 tons for the season."

This gain has been made in the presence of low water throughout the season, so that "there are many places between Buffalo and Duluth which will scarcely admit of passage," and it is predicted that when the new lock is completed, with the improvement of the channels now specified and shortly to be let, the capacity of the existing steamers will be increased by nearly 50 per cent.

LOCOMOTIVE BUILDING.

The Baltimore & Ohio has contracted with the Baldwin Locomotive Works for 60 locomotives.

The Schenectady Locomotive Works are building two locomotives for the Terminal Railroad Association of St. Louis.

The Brooks Locomotive Works have an order for 10 switching locomotives for the Lake Shore & Michigan Southern.

The St. Paul & Duluth is preparing plans for a heavy transfer engine and will soon receive bids for its construction.

The Manchester Locomotive Works, of Manchester, N. H., are building five 8-wheel passenger locomotives for the Old Colony.

The Brooks Locomotive Works shipped the first of an order for passenger engines for the Buffalo, Rochester & Pittsburgh last week.

The Baldwin Locomotive Works have an order for four engines for the Richmond & Danville, and for two 10-wheel engines for the Valley (Ohio) road.

The Great Northern will soon place orders for 50 locomotives. Of these, 20 will be mogul freight engines and the balance heavy passenger engines. The Brooks Locomotive Works will soon begin delivering 25 engines ordered in September.

The Cleveland, Cincinnati, Chicago & St. Louis has contracted with the Schenectady Locomotive Works for 10 heavy switching engines, to be delivered by Dec. 17. This company has, within the last 30 days, received from the Brooks Locomotive Works 10 switching engines. It is now receiving 30 freight locomotives, ordered last April from the Richmond Locomotive Works. The Schenectady Locomotive Works have the contract, also, to build 10 passenger engines for the road; and by Jan. 1 the company will have received, since Oct. 1, 60 new locomotives.

CAR BUILDING.

The Chesapeake & Ohio will soon place orders for 2,000 cars, 1,000 of the number being box cars.

The Huntingdon & Broad Top has just ordered 250 coal cars, and other equipment will soon be contracted for.

The Duluth & Iron Range has issued specifications for 500 ore cars, to be 22 ft. long, having Safford drawbars, National hollow brakebeams, and the Westinghouse brakes on both trucks.

The Green Bay, Winona & St. Paul has ordered 1,000 cars, and 1,500 box cars have been ordered for use on the Northwestern Dispatch Fast Freight via Frankfort and Kewannee.

The Baltimore & Ohio this week placed orders for 2,000 box cars, of large capacity, and 500 gondolas. General Manager Odell has ordered the employment of 2,000 additional workmen at the company's shops at Mount Clare, Pittsburgh, Grafton, W. Va., and Newark, O.

The Terre Haute Car Co. is delivering 12 cars a day to the St. Louis, Vandalia & Terre Haute, on the order for 1,200 freight cars given some months ago. The cars have automatic couplers, air brakes and other safety appliances.

The Wagner Palace Car Co. is building a new private car for President Newell of the Lake Shore & Michigan Southern. The interior is in mahogany finish, with rich effects in hand-carving and paneling. At one end is a commodious parlor and dining-room and at the other the observation room.

The Gilbert Car Manufacturing Co., of Troy, N. Y., has received a contract from the New York Central & Hudson River road for building 130 cars for passenger service. The order includes twenty 54-ft. smoking cars; fifty 54-ft. day cars; ten 60-ft. combination cars; twenty 60-ft. vestibule day cars and thirty 60-ft. baggage cars.

BRIDGE BUILDING.

Albany, N. Y.—The New York State Canal Board has approved plans for a lift bridge over the Erie at Water street, in Albany. The new bridge will take the place of the old structure at the foot of Lawrence street and will be similar to the new bridge at the foot of North Ferry street. The bridge will cost about $12,000.

Baltimore, Md.—The Mayor in a message to the City Council recommends that provision be at once made for constructing a new bridge over the falls on Baltimore street. This is required by the widening of the Baltimore street narrows. Plans have been prepared and an ordinance will be submitted authorizing the work to be promptly done.

Brantford, Ont.—The Toronto, Hamilton & Buffalo is going ahead with its railroad bridge at Brantford. Men are working at Hagersville getting out stone for the bridge over the Grand Trunk. The contractors for the bridge foundations are Hopkins & Co., of St. Louis, Mo. The superstructure is now being built by the Dominion Bridge Co., of Montreal.

Great Northern.—Contracts for plate girder bridges at Coon Creek and Rice Creek, Minn., have been let by the Great Northern Railway to the Edge Moor Bridge Works.

Kingston, Ont.—A petition has been presented to the County Council asking for permission to bridge the channel between Howe's Island and Pittsburgh. It is proposed to build a swing bridge that navigation may not be interfered with.

Minneapolis, Minn.—The Great Northern has awarded the contract for the superstructure of the Third street highway bridge, across the right of way of the company, to the Edge Moor Bridge Works, of Wilmington, Del.

New Brunswick.—The local government is getting along well with the bridges which it has under construction or repair. Besides the Woodstock bridge, the bridge over the Petitcodiac River at Moncton, N. B., is about completed and work has been commenced on the the bridge at Killam's mills, near Elgin Corner, on the Polloett River in Albert County. This bridge is to be of steel with stone abutments.

New Westminster, B. C.—Tenders are called for the construction of a bridge across the Lillooet Stream, at Maple Ridge, B. C.

Omaha, Neb.—The organization of the Omaha Bridge & Terminal Railway Co. to build the bridge across the Missouri River, proposed by the Interstate Bridge & Street Railway Co., has already been noted in these columns. A charter was secured from Congress by the latter company over two years ago authorizing the building of a low bridge between Council Bluffs and East Omaha, but the project for a long time made no progress and seemed to be abandoned. Within a few months the organization of the new company has been made public, and it is announced that Drexel & Co., of Philadelphia, have subscribed for $5,000,000 of the company's bonds, and plans have been enlarged to include not only the bridge over the Missouri River, but an extensive system of terminal tracks, a belt railroad, union station, and freight house at Omaha. The contract for the piers has been let to Sooy Smith & Co., and for the superstructure to the Phœnix Bridge Co. The piers will be sunk to a depth of 125 ft. below extreme low water. The fixed span will be 560 ft. long and the draw span 520 ft. weighing on the turn-table about 3,700,000 lbs. The bridge will accommodate a double track railroad, a double track motor line and also two sidewalks. Teams will cross on the motor way. The cost of the structure is estimated at $1,000,000. The plans are being completed by J. A. L. Waddell, of Omaha, the Chief Engineer, and it is proposed to begin work before the next high water in April. A. S. Potter is General Manager of the company.

Ottawa, Ont.—The Ottawa, Arnprior & Parry Sound has asked for permission to build a bridge over the Canadian Pacific within the limits of this city, the bridge to have a span of 40 ft.

R. C. Carter, of Deseronto, Ont., has made an application to Parliament for permission to extend the Thousand Island railroad along Water and John streets, Gananoque, Ont., also to construct a swing bridge across the Gananoque River.

San Francisco.—The Board of Supervisors have awarded to B. McMahon & Son the contract to construct a steel bridge over Channel street at Fourth at a cost of $23,800.

Toronto.—The Chairman of the Markets Committee is calling for tenders for the erection of a steel overhead bridge at the city cattle market.

Winnipeg.—Alderman Ross has given notice that at the next meeting of the council he will introduce a by-law to provide for the construction of the long proposed bridge over the Assiniboine River at Main street and for the submission of the said by-law to vote of the ratepayers.

RAILROAD LAW—NOTES OF DECISIONS.

Powers, Liabilities and Regulation of Railroads.

The Supreme Court of the United States decides that the transportation of goods and passengers by continuous carriage from one point in a state to another point in the same state is not interstate commerce, within the meaning of the Federal constitution, although for a part of the route it is over the soil of another state; and therefore it is within the power of the state wherein it begins and ends to impose a tax on its gross receipts.[1]

The Federal Circuit Court lays it down that the commercial power of Congress is exclusive of state authority only where the subjects upon which it is exerted are national in their character, and admit and require uniformity of regulations affecting alike all the states; and when the subjects within that power are local in their nature or operation, or constitute mere aids to commerce, the states may provide for their regulation and management until Congress intervenes and supersedes their action. The erection of a bridge entirely within a state across a navigable river running partly within and partly without the state is not a matter so intimately connected with interstate commerce as to be under the exclusive control of Congress; and in the absence of congressional action, the state has authority to regulate the same.[2]

In Texas the Supreme Court rules that the provision in a contract for the construction of a railroad that, in case the company is delayed in acquiring title to lands, or for other reasons, the contractor shall not be entitled to damages therefor, but shall have extension of time, does not apply to delay caused by the company in failing to have a survey made for the work.[3]

The Supreme Court of Tennessee holds that where the servants of a railroad company, acting within the scope of their duty, allow a train of cars to obstruct a highway for more than 20 minutes, it is no defense to an indictment against the company that its rules forbade such obstructions for more than five minutes.[4]

In Texas a railroad company promised, in consideration of a right of way, to construct and maintain a station on the land granted, which it afterward refused to do. The Supreme Court decides that if the promise was made with a design to deceive the grantor, having no intention of performance at the time, that fact, with the refusal to maintain the station, would entitle the grantor to a cancellation of the deed on the ground of fraud; but if the contract was made in good faith, and the failure of performance was a subsequent change of plan, the grantor would only be entitled to his damages for breach of contract; and the question of the company's good faith in making the contract is for a jury.[5]

In Texas, a receiver is not a "proprietor, owner, charterer, or hirer," within a statute giving a right of action for injuries resulting in death caused by the negligence of the proprietor, owner, charterer, or hirer of a railroad, etc., or by the negligence of their servants or agents.[6]

In New York, according to the Court of Appeals, a statute which imposes on railroad companies constructing lines across a public highway the duty of restoring the same "to its former state or to such state as not necessarily to impair its usefulness," does not relieve the commissioner of highways from the care and control of the approaches to the railroad, though they were constructed by the company as a part of its duty.[7]

Injuries to Passengers, Employees and Strangers.

In Georgia a passenger on a railroad train who refuses to accede to a wrongful demand for fare is entitled to be carried on acceding to the demand, though the train may have been stopped with a view to his expulsion; but

if the demand upon him is rightful he cannot avoid expulsion by tendering the fare while the train is being stopped or after the stoppage.[9]

In a case in New York, the plaintiff having paid his fare boarded defendant's elevated railroad train by leaping on the rear platform in violation of a rule of the company. His valise having been tossed to the platform of the next station he recovered it and returned into the train whence defendant's servants attempted to eject him. The court holds that no matter what the irregularity of plaintiff was in boarding the train his presence there was rightful, and defendant was liable for his injuries resulting from the attempted ejection.[9]

In Georgia, the Supreme Court rules that when a railroad sells a ticket to a flag station at which its trains do not stop unless signaled to do so for the purpose of receiving or discharging passengers, it is ordinarily the duty of the conductor, before reaching the station, to ascertain from the passenger holding such ticket his destination, and to stop the train there for the purpose of allowing the passenger to leave the train.[10]

In Kentucky a passenger on a train, when it arrived at a station at night, got off on the side opposite the platform, which platform was safe and well lighted. He knew which side the platform was on, but took the opposite side, to save a walk of 8 ft., and by reason of the darkness stumbled over a water box, throwing one of his hands under the train and was injured. The train stopped four minutes, and plaintiff, by the use of ordinary prudence, could have left the cars and depot grounds with reasonable safety had he taken the platform side. The Supreme Court holds that plaintiff left the cars at his own risk, the defendant not being required to have the side opposite the platform lighted, even though plaintiff and others had sometimes gotten on and off before on that side as a matter of convenience to themselves.[11]

The Supreme Court of New York decides that an action may be maintained against a railroad for forcibly ejecting a disorderly person from a train while in motion.[12]

In Washington a passenger car, uncoupled from the engine, which had preceded it and moved onto another track, arrived at a switch where it was the custom to take up passengers, and was left standing alone. Plaintiff, who was aware of this custom, was waiting to be taken up, with his bundle on his shoulder, and the conductor came out on the rear platform of the car and called to him to board the car, and directed him to stand on the track between the rails and place his bundle at the end of the rear platform before mounting. While so doing the car was pushed by the engine onto the plaintiff and he was injured. The Supreme Court holds the railroad liable.[13]

The Federal Court of Appeals rules that the negligence of a fellow-servant does not excuse the master from liability for an accident which would not have happened had the master performed his duty. Negligence cannot be imputed to a fireman because he does not endeavor to enforce upon the engineer obedience to the regulations of the railroad.[14]

The same court in the same case holds that the fact that a servant continues in a dangerous service in consequence of the master's assurances that the danger shall be removed, precludes any argument that the servant, by remaining, assumes its risks, and recovery can be had for an injury caused by the defect after the lapse of a reasonable time for its correction.[15]

In Texas a brakeman who, while running to set up a switch on a foggy morning, is injured by falling over a timber lying close to the track, and which was not there when he was last over the road, is entitled, in the absence of contributory negligence, to recover for the injury.[16]

In New York a brakeman was killed while on the roof of a box car by striking the beam of a bridge under which the train was passing; the car was 16 or 18 inches higher than those commonly used, and he could not pass under the bridge, standing erect on the car; he mounted the car either under the danger signals (bridge warning) or near them, on the side toward the bridge; there was nothing to obstruct his view of the danger signals or the bridge. The Supreme Court holds the railroad not liable.[17]

In New York it is held that where it appeared that a railroad company laid its tracks upon and across a bridge constructed and maintained by the state, and that plaintiff was injured while a passenger in one of its cars by the falling of balance weights used in elevating and lowering the bridge, which were suspended by a defective appliance, whose imperfection could have been easily discovered by the manufacturer, and there was no evidence that defendant had ever inspected the bridge, the court properly directed a verdict for plaintiff.[18]

In a case in the Supreme Court of the United States the plaintiff testified that he was working with other laborers for the company on the west bank of a river, and that it was the custom of the company to carry them across the bridge on cars at the end of each day; that on the day he was hurt the boss told them they would be safe, as no engine would cross for about two hours; that on account of a lame side he was unable to keep up with the others; that there was no room to walk on the side of the track, but that one could step aside and wait for a train to pass; that the train met him about the middle of the bridge, but he did not see it until it was right on him, because it was coming around a curve; that he was walking at his ease, not thinking of anything, because the boss told them there was no train to cross; and that he tried to get out of the way but slipped on the track, which was frozen, and fell catching his leg under the wheel. The Supreme Court (Justices Brewer and Brown dissenting) affirms a verdict against the railroad.[19]

In New York while a brakeman was setting a brake it broke, and he was killed. "Four of the six spokes of the wheel on the brake were broken off where their ends joined the rim. The ends thus broken were rusty, showing that they had been broken for a long time. The other spokes were freshly broken. Defendant introduced in evidence an agreement signed by deceased when he entered its employ, wherein he promised to examine the condition of all machinery, tools, tracks, cars, etc., before using them or exposing himself, and agreeing that the company should not be responsible for the consequences of his own neglect. The agreement also provided that it was the right of the deceased to take sufficient time before exposing himself, and to make such examination as he had agreed, and to refuse to obey any order which would expose him to danger. The Supreme Court affirms a judgment against the railroad, holding that the question of deceased's negligence was properly submitted to the jury, since the evidence tended to show that it would have required an expert to discover the defects in the brake.[20]

[1] Lehigh Valley R. R. v. Com., 12 S. C. Rep., 806.
[2] Rhea, v. N. N. & M. V. R. Co., 50 Fed. Rep., 16.
[3] O'Connor v. Smith, 19 S. W. Rep., 168.
[4] State v. L. & N. R. Co., 19 S. W. Rep., 229.
[5] Chi. T. & M. C. Ry. Co., v. Titterington, 19 S. W. Rep., 472.
[6] Yoakum v. Selph, 19 S. W. Rep., 145.
[7] Bryant v. Town of Randolph, 30 N. E. Rep., 658.
[8] Georgia S. & F. R. Co. v. Asmore, 15 S. E. Rep., 13.
[9] Smith v. Manhattan R. Co., 18 N. Y. S., 759.
[10] C. R. & C. R. Co. v. Lyon, 15 S. E. Rep., 24.
[11] L. & N. R. Co. v. Ricketts, 19 S. W. Rep., 182.
[12] Oppenheimer v. Man. R. Co., 18 N. Y. S., 411.
[13] Just v. N. P. R. Co., 29 Pac. Rep., 845.
[14] N. J. & N. Y. R. Co. v. Young, 49 Fed. Rep., 723.
[15] N. J. & N. Y. R. Co. v. Young, 49 Fed. Rep., 723.
[16] So. Pac. Ry. Co. v. Markey, 19 S. W. Rep., 392.
[17] Lynch v. N. Y., L. E. & W. R. Co., 18 N. Y. S., 417.
[18] Birmingham v. Roch. City & B. R. Co., 18 N. Y. S., 649.
[19] North Pac. R. Co. v. Amato, 12 S. C. Rep., 740.
[20] Pratt v. L. S. & M. S. Ry. Co., 18 N. Y. S., 682.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Chicago, Burlington & Quincy, quarterly, 1¼ per cent, payable Dec. 15.

Cleveland & Pittsburgh, quarterly, 1¾ per cent., payable Dec. 1.

North Pennsylvania, quarterly, 2 per cent., payable Nov. 25.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Baltimore & Ohio, annual, Baltimore, Md., Nov. 21.

Buffalo, Rochester & Pittsburgh, annual, New York City, Nov. 21.

New York, Lake Erie & Western, annual, New York City, Nov. 29.

New York & New England, special, Boston, Mass., Nov. 21, to approve the lease of the Providence & Springfield.

Philadelphia, Newtown & New York, special, Norristown, Pa., Nov. 28, to consider an increase of bonds to $1,600,000.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *Roadmasters' Association of America* will hold its next annual meeting at Lookout Mountain Hotel, Chattanooga, Tenn., beginning Nov. 15, having been postponed from Oct. 18.

The *New England Railroad Club* holds regular meetings, at the United States Hotel, Beach street, Boston, Mass., on the second Wednesday of each alternate month commencing January.

The *Western Railway Club* holds regular meetings on the third Tuesday in each month, except June, July and August, at the rooms of the Central Traffic Association in the Rookery Building, Chicago, at 2 p. m.

The *New York Railroad Club* holds regular meetings on the third Thursday in each month, at 7:30 p. m., at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, N. Y.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, the fourth Wednesday of January, March, May, September and November.

The *Northwest Railroad Club* meets on the first Saturday of each month, except June, July and August, in he St. Paul Union Station, at 7:30 p. m.

The *Northwestern Track and Bridge Association* meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m. in the directors' room of the St. Paul Union Station.

The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street, New York.

The *Boston Society of Civil Engineers* holds its regular meetings at Wesleyan Hall, Bromfield street, Boston, at 7:30 p. m., on the third Wednesday in each month.

The *Western Society of Engineers* holds its regular meetings at 78 La Salle street, Chicago, at 8 p. m., on the first Wednesday in each month.

The *Engineers' Club of St. Louis* holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive streets, St. Louis, on the first and third Wednesday in each month.

The *Engineers' Club of Philadelphia* holds regular meetings at the House of the Club, 1,122 Girard street, Philadelphia, on the first and third Saturday of each month. The annual meeting is held on the third Saturday in January.

The *Engineers' Society of Western Pennsylvania* holds regular meetings on the third Tuesday in each month, at 7:30 p. m., at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa.

The *Engineers' Club of Cincinnati* holds its regular meetings at 8 p. m. on the third Thursday of each month in the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati.

The *Civil Engineers' Club of Cleveland* holds regular meetings on the second Tuesday of each month, at 8 p. m., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the South* holds its monthly meetings on the second Thursday at 8 p. m. The Association headquarters are at Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The *Denver Society of Civil Engineers and Architects* holds regular meetings at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesday of each month, at 8 o'clock p. m., except during June, July and August, when they are held on the second Tuesday only.

The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7:30 p. m., on the third Saturday in each month.

The *Civil Engineers' Association of Kansas* holds regular meetings at Wichita on the second Wednesday of each month at 7:30 p. m.

The *American Society of Swedish Engineers* holds meetings at the club house, 250 Union street, Brooklyn, N. Y., and at 347 North Ninth street, Philadelphia, on the first Saturday of each month.

The *Engineers' Club of Minneapolis* meets the first Thursday of each month in the Public Library Building, Minneapolis, Minn.

The *Canadian Society of Civil Engineers* holds regular meetings at its rooms, 112 Mansfield street, Montreal, P. Que., every alternate Thursday except during the months of June, July, August and September.

The *Association of Civil Engineers of Dallas* meets at 803 Commerce street, Dallas, Tex., on the first Friday of each month at 4 o'clock p. m.

The *Technical Society of the Pacific Coast* holds regular meetings at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., at 8 o'clock p. m. on the first Friday of each month.

The *Tacoma Society of Civil Engineers and Architects* holds regular meetings on the third Friday of each month, in its rooms, 201 and 202 Washington Building, Tacoma, Wash.

The *Association of Engineers of Virginia* holds regular meetings at Roanoke, on the second Saturday in each month, at 8 p. m., except the months of July and August.

The *Engineers' and Architects' Club of Louisville* holds regular meetings on the second Thursday of each month, at 8 o'clock p. m., at its rooms in the Norton Building, Louisville, Ky.

American Society of Civil Engineers.

At the meeting held on Nov. 2, 1892, the paper by William L. Saunders, M. Am. Soc. C. E., on "Electric Rock Blasting—The American Method," was read by the Secretary and discussed at some length.

Spencer Miller, M. Am. Soc. C. E., called attention to the low cost at which Mr. Edison claims to be blasting and moving iron ore at the New Jersey and Pennsylvania Concentrating Works at Ogden, N. J. An interesting piece of information has been worked out there, showing the cost of wear and tear and interest on plant to amount to one cent per ton handled.

Samuel Whinery, Vice-President Am. Soc. C. E., gave experience of twelve years ago when in Government employ, in blasting rock, both under water and in quarries. A very accurate account of all expenses was kept, and all blasting was done by electricity. In a quarry of solid limestone, with a face 50 ft. high, and ledges 6 to 12 ft. thick, the stone being moved from the level of the bottom, a distance of about 60 ft., to flatboats, the actual cost of rip-rap stone for labor, tools and material was 28⅝ cents per cubic yard, as measured in the solid rock by cross-sectioning. This was the average on three months' work. Large masses were moved by derricks. Water tamping was found to be insufficient in 18 in. depth of water. Sharp sand in water did not give a good result. Plaster of paris succeeded, but was expensive. Pebbles screened to obtain those about the size of grains of corn were best. Mr. Whinery advocated the use of testing apparatus, and described a simple one he used successfully. He stated that every fuse should be tested, and the result will be a large saving of time. He further stated that leading wires for moderate distances need not be insulated, and four exploders can be fired with a naked wire passing through 100 ft. of water.

Much of the material in the use of high explosives is wasted. It is almost impossible to get foremen to use only a sufficient quantity of dynamite. The desired result was reached in this case by a rod of wood, one side of which was graduated to feet and tenths and the other side to inches of dynamite to be used, the latter being obtained by computation. This was used by laying it on the rock, in the direction of the line of least resistence, and employing the amount of dynamite indicated on the rod for the distance measured. The saving of 50 per cent. was effected by this means.

A. M. C. Parker, M. Am. Soc. C. E., stated that in blasting at 125th street, to get a uniform depth of 12 ft. at low tide, or 17 ft. at high tide, he had fired seven holes with no attention to insulation of the wires. "The rack-a-rock" explosive has been used, and it often happens that the exploders are fired without firing the cartridge; this is, however, believed never to occur with dynamite. In this depth of water, there has been no trouble about tamping.

E. P. North, M. Am. Soc. C. E., mentioned a case of chilled dynamite cartride six ft. under water which was not fired by an 8 grain exploder, the latter being thrown out only. Two such exploders fired the cartridge.

Written discussions on this paper, and also on the paper by Mr. Saabye on "A Cheap Dam" (read Oct. 19, 1892), may be sent in until Dec. 15. Copies of these papers will be sent on request to those wishing to discuss them.

At the meeting held on the evening of Nov. 16, a paper was read by James Owen, M. Am. Soc. C. E., on the subject of "Repairs and Maintenance of Roads."

Mr. Owen discussed somewhat briefly some disputed points in grade, drainage, foundations, thickness, material, construction, size of stone and repairs in the making of roads. As to thickness, Mr. Owen does not believe in a four-inch road, except perhaps on rather steep grades, stating that so thin a road is apt to break up in the spring. He prefers an 8-in. thickness, or not less than 6 in., and as to material gives the preference to trap rock over granite and to granite over limestone, believing that the value of limestone is only comparative with a mud foundation.

Discussion followed by Messrs. North, Brush, Collingwood and Cole. Mr. North called attention to the fact that principles in road making were laid down here that might hold good in other countries, but would not apply in this, owing to difference in climatic conditions, stating that the landscape architects who laid out Central Park, believing that wet was the great enemy of macadam roads, had made a veritable Sahara of them, while in this climate dryness was the chief difficulty so that it was necessary to keep these roads constantly sprinkled to prevent their breaking up and that shade trees should have been liberally supplied along the roads. Mr. North differed with Mr. Owen as to the use of steam and horse rollers, Mr. Owen preferring the horse roller, and Mr. Brush stated that some years ago two roads had been built on the same ridge, the Palisade ridge in New Jersey, on one of which the steam roller had been used and on the other the horse rolier; that for five or six years little attention had been paid to them in the way of repairs, but that both had worn equally well.

The Secretary announced that the paper for the next meeting, Dec. 7, would be by James D. Schuyler on "The Lining of Reservoirs with Asphalt."

Central Railway Club.

The next meeting of this Club will be held at the Hotel Iroquois, Buffalo, Wednesday, Nov. 23, at 9:30 a. m. The subject for discussion is "What May Be Considered Home Defects on Freight Cars; Defects That May Be Passed to Owners by Inspectors."

Roadmasters' Association.

The convention of the Roadmasters' Association, of America, was called together at the Read House, Chattanooga, Tenn., by President Doyle, on Tuesday morning Nov. 15, at 9 a. m.

The President called the convention to order and said, "I will not detain you with a speech now, for we are going to open our Convention in Atlanta in the morning. I have the honor this morning to introduce to you Capt. J. W. Craig, who will say a few words."

Capt. Craig welcomed the members of the Association to the South and said a few words about the programme. He then introduced Roadmaster, W. G. Ward, from the South Carolina Railroad, who also said a few words of welcome. Mr. W. H. Reed was then called upon by the chair and spoke very briefly, welcoming the Northern visitors. These speeches were replied to by Mr. W. H. Stearns.

Letters were read from the Division Superintendent of the Wagner Palace Car Co. and Pullman's Palace Car Co., stating that arrrangements had been made for giving the delegates every accommodation on the cars of these companies on the return trip from Atlanta.

After receiving the reports of officers the meeting adjourned to meet at Concordia Hall in Atlanta, Nov. 16, at 9 A. M.

Immediately after adjournment the members and guests took cars to Lookout Mountain. About an hour and a half was spent on the mountain, when the party returned to Chattanooga, and were thence conveyed by a special train to Atlanta.

The Civil Engineer's Society of St. Paul.

A regular meeting of the society was held Nov. 9, nine members present, including President Woodman. The committee on transportation for the excursion to West Superior and vicinity reported a favorable arrangement and various details of the trip were discussed. Thursday evening, Nov. 10, was the date fixed for departure.

PERSONAL.

—Mr. J. S. Taylor, Secretary of the Philadelphia & Reading road, sailed for London this week, and is expected to return about Jan. 1.

—Mr. A. C. Michaelis, General Freight and Passenger Agent of the Mexican Central has resigned, and it is reported has accepted an office in England. Mr. H. B. Wilkins, Assistant General Freight and Passenger Agent, has been appointed Acting General Freight and Passenger Agent.

—Mr. J. C. Brennan, General Roadmaster of the Great Northern, died last week from blood poisoning resulting from a slight injury caused by jumping from an engine. Mr. Brennan had occupied the position of General Roadmaster for over 13 years and was highly esteemed by the officials of the road and railroad men generally throughout the northwest.

—Mr. Charles H. Cromwell, formerly General Freight Agent of the Western Railway of Alabama, and recently a joint receiver of the Atlantic & Danville, died at Montgomery, Ala., Nov. 13, after an illness of two weeks. About a year ago, during his term as receiver, Mr. Cromwell suffered a stroke of paralysis, and since then he has not been able to engage in active business.

—Col. Robert C. Morris, Chief Engineer of the Nashville, Chattanooga & St. Louis, died at Nashville, Tenn., Nov. 8, after an illness of several weeks. He was born in Tennessee in 1817. In 1847 he was appointed an Assistant Engineer on the East Tennessee & Georgia road, and he became Resident Engineer of that road and the East Tennessee & Virginia in 1865, and two years later Chief Engineer of the Knoxville & Charleston. He was Chief Engineer of the Nashville, Chattanooga & St. Louis for the last 23 years.

—Mr. August Mordecai, has, as noted last week, been appointed Civil Engineer of the New York, Lake Erie & Western; and we publish below additional particulars of Mr. Mordecai's railroad career. He was graduated from the Polytechnic College of Philadelphia, in the year 1856 and commenced his railroad experience on the Pennsylvania Railroad as rodman on the Philadelphia Division. He was later Division Engineer in charge of the construction of a part of the Hartford & Connecticut Western Road in Connecticut. In 1869 he was Division Engineer on what was then called the St. Louis, Council Bluffs & Omaha Railroad, in Missouri. In 1871 he was on the Pittsburgh, Virginia & Charleston Railroad, near Pittsburgh, Penna. In the fall of 1872, he was appointed Resident Engineer of what was then the Mahoning Division of the Atlantic & Great Western Road at Cleveland, Ohio, and he has been connected with that road and its successors, ever since, as Resident Engineer, Assistant Engineer, Engineer Maintenance of Way, and General Road Master, being appointed to the latter position in January 1888.

ELECTIONS AND APPOINTMENTS.

Adirondack & St. Lawrence.—Samuel Goodman, Assistant General Freight Agent of the New York Central, has been appointed General Freight Agent of this road in charge of the freight traffic of the line, with headquarters at Grand Central Station, New York city.

Baltimore & Ohio.—Superintendent P. C. Sneed has appointed H. W. Getz Trainmaster in charge of the Chicago terminals and the movement of trains between Whitings and Chicago, with headquarters at South Chicago.

Bare Rock.—The first directors of this new Pennsylvania company are John Murdock, Johnstown, Pa., President; J. C. Duncan and H. E. Woodward, Johnstown; Samuel Fox and Josiah Way, Somerset, Pa.; S. E. Gill, Pittsburgh, and E. B. McColby, Ligonier.

Canadian Pacific.—Mr. Tweedie, Roadmaster on the Calgary & Edmonton, has been appointed Roadmaster of this road, from Gleichen to Canmore, succeeding W. A. Perry, who was lately drowned at Kananaskis Falls. Mr. Bruce, Section Foreman at Caedale, succeeds Tweedie on the Calgary & Edmonton.

Central of Georgia.—F. S. Jette has been appointed Superintendent of Transportation for the road. Mr. Jette has been with the company for some time, having served as Chief Clerk under Messrs. Gabbett, McBee and Wadley.

Chicago & Erie.—At the annual meeting at Huntington, Ind., Nov. 15, the following directors were elected: J. G. McCullough, John King, E. B. Thomas, Samuel Spencer, James H. Benedict, G. H. Vaillant, Andrew Donaldson and Andrew W. Kent, of New York; Jay C. Morse and Volney T. Malott, of Chicago; Simon Perkins, of Sharon, Pa.; John Tod, of Cleveland, O.; and M. D. Woodford, of Cincinnati, O. The officers are: J. G. McCullough, President; E. B. Thomas, G. H. Vaillant, Vice-Presidents; Edward White, Treasurer; Arthur Turnbull, Secretary.

Denver, Lakewood & Golden.—H. S. Grimshaw has been appointed Assistant Superintendent of the road, with office at Denver, Col.

Eastern of Minnesota.—M. Deviney, formerly roadmaster of the Great Northern, has been appointed roadmaster, vice James Brennan transferred to the Great Northern.

East Tennessee, Virginia & Georgia.—At the stockholders' meeting in Knoxville, Nov. 16, the following directors were elected: George F. Stone, W. E. Strong, W. P. Clyde, T. F. Ryan, R. S. Hayes, J. C. Maben, W. G. Oakman, T. L. Manson, Jr., George J. Gould, R. G. Erwin, C. M. McGhee, Samuel Thomas, John G. Moore, Calvin S. Brice and E. J. Sanford. A majority of these directors are directors of the Richmond Terminal Co.

Fitchburg.—P. Snyder, of Mechanicville, N. Y., has been appointed Superintendent of the Western division to fill the position made vacant by the resignation of Joseph Crandell. He will have his headquarters at Mechanicville.

Great Northern.—James Brennan, formerly roadmaster of the Eastern on Minnesota, has been appointed general roadmaster, with headquarters at St. Paul Minn., vice John Brennan deceased.

Huntingdon & Broad Top.—Johns Hopkins has been elected Vice-President. The office is a new one and was established at the request of President S. M Janney. Mr. Hopkins has been connected with the company for some years as a director. He is President of the Johns Hopkins Oil Co.

Kennebec Central.—The annual meeting was held at Gardiner, Me., Nov. 7. The following Board of Directors was elected: Weston Lewis, J. S. Maxey, A. C. Stilphen, H. W. Jewett, J. B. Dingley. The Board elected Weston Lewis as President, A. C. Stilphen General Counsel.

Louisville, Evansille & St. Louis.—H. E. Craft has been appointed Master of Transportation, with office at Evansville, Ind. Mr. Craft was formerly Superintendent of Transportation, and was succeeded about a year ago by Morris McDonald, Jr., formerly his Chief Clerk, who is now succeeded by his former superior.

Montgomery & Eufaula.—The annual meeeting was held at Montgomery, Ala., Nov. 11. The old Board of Directors was re-elected except that John P. Bullock, and H. M. Comer, of Savannah, were elected in place of E. P. Alexander and V. E. McBee. The other directors are I. Pollack, J. R. Warren, Charles A. Sterne, of this city, J. W. Tullis, G. L. Comer and S. H. Dent, Eufaula; W. Stakeley, Union Springs. H. M. Comer, President of the Central of Georgia, was made President, W. E. McIntyre, Treasurer, and E. Workman, Secretary.

New York, Lake Erie & Western.—J. D Remington has been appointed Traveling Freight Agent of this company, with headquarters at Philadelphia, Pa.

Paducah, Tennessee & Alabama.—A. R Meyers, in addition to his duties as Auditor of the above road, has been appointed Auditor of the Tennessee Midland, with office at Paducah, Ky. R. G. Browning, heretofore Auditor of the Tennessee Midland, has been appointed Assistant Auditor of the two roads, with office at Paducah.

Philadelphia & Reading.—The appointment is announced of Francis L. Gowen as Chief Assistant General Solicitor. Mr. Gowen is a nephew of the late President Gowen and son of the late James E. Gowen, for many years General Counsel of the company.

St. Louis, Merchants' Bridge & Terminal Co.—The annual meeting was held at the company's office in the Laclede Building last week, and the following directors were elected: C. C. Rainwater, C. D. McLure, John Whittaker, C. C. Maffitt, Paul A. Fuss, L. M. Rumsey, John D. Perry, Adolphus Busch, D. R. Francis, John H. Overall, John T. Davis.

Seattle & Montana.—J. C. Copeland has been appointed Superintendent of the road, also of the Fairhaven & Southern and New Wesminster Southern. Mr. Copeland's headquarters are at Seattle, Wash.

Upper Coos.—At the annual meeting of the directors of this New Hampshire line George Van Dyke was re-elected President, C. B. Jordan, Clerk, and T. S. McGowen, Treasurer.

Wabash.—W. F. Dimmick has been appointed to succeed E. M. Meriwether, resigned, as General Roadmaster of the middle division with headquarters at Decatur, Ill.

Wickes Refrigerator Co.—George F. Brown, Jr., has been elected President of the Wickes Refrigerator Co., in place of James H. Wickes, deceased. Walter H. Wickes has been elected Secretary and Treasurer of the company in place of George F. Brown, Jr.

Wisconsin Central.—At the annual meeting of the company the following Board of Directors was chosen: E. H. Abbot, Eustace C. Fitz and John F. Anderson, Boston; Samuel R. Ainslie, Chicago; Jeremiah Smith and Philip S. Abbot, of Cambridge, Mass.; Rowland G. Hazard, of Peace Dale, R. I.; George W. Johnson, of Brookfield, Mass.; William L. Bull, of New York city; Frederick Abbot and Howard Morris, of Milwaukee. The officers elected: Edwin H. Abbot, President and Treasurer; Frederick Abbot, Vice-President and Assistant Treasurer.

RAILROAD CONSTRUCTION.

Incorporations, Surveys, Etc.

Bare Rock.—This company was incorporated in Pennsylvania on Nov. 14 to build a road from Bare Rock to Way Station both in Black township, Somerset County, Way Station, being on the Somerset & Cambridge branch of the Baltimore & Ohio, which extends from Rockwood to Johnstown, Pa. The length of the road is 2½ miles, and the capital stock is $25,000. John Murdock, Johnstown, Pa., is President.

California & Northeastern.—Articles of incorporation have been filed in California, to build two lines, aggregating about 40 miles of road. One line is from Anderson in Shasta County to the Sacramento River, and to a point in Section 17, T. 32, North, also a line northeasterly to Township 34 N., in Shasta County. The incorporators are Joseph E. Barry, Solomon Bloom, Edward B. Young, Marcus D. Hyde, James Spiers and W. H. Smith. The capital is $200,000, of which $39,500 has been subscribed.

Charles City & Southern.—This company has filed articles of incorporation in Iowa to construct the road from Charles City to the south to connect with the Burligton, Cedar Rapids & Northern, referred to recently. The incorporators are men of Charles City. It is probable that the road will be built to Clarksville, in Butler county.

Chesapeake & Ohio.—During the past year 32 miles of new second track has been built on the Huntington division of this road, west of the Alleghany Mountains, between Clifton Forge and Hinton, W. Va. Eighteen miles of the second track, between Covington and Low Moor, 8¼ miles, and between Alderson and Lowell, W. Va., 9¼ miles, which was under contract in January is now in operation. The track is now being laid by the company's forces on the balance of the work, which was placed under contract in May.

Chicago, Rock Island & Texas.—The tracklaying south of Red River is still in progress, and it is expected that the rails will be laid into Bowie, Tex., about Dec. 1. Trains will probably be running into that town by Dec. 15. It is about 24 miles south of the Red River and 128 miles south of Minco, I. T., which was the terminus of this line at the beginning of the year. All but one of the engineering parties on the extension have been disbanded, and no preparation has been made to do any work on the line south of Bowie this winter. It is not even known whether the location south of that point has been adopted, but that the line will be extended south toward Fort Worth or Dallas is confidently believed.

Clarksville Mineral.—The officers of the Louisville & Nashville, by which company this road is being built, have arranged to complete the tracklaying by Dec. 1 on the unfinished seven mile section. The work is on the middle part of the road between Marion and Van Leer, and when the track has been laid the line will be opened for traffic from Clarksville on the Memphis Line of the Louisville & Nashville south to Dickson on the Nashville, Chattanooga & St. Louis. The distance between these points is 25 miles, and most of the work was completed in 1891. C. O. Bradford, of Louisville, of the Louisville & Nashville, has charge of the construction of the road.

Clear Lake & Russian River.—At a meeting of the directors of this recently organized company at Lakeport, Cal., Nov. 2. The following officers were elected: President, Frank W. Gibson; Vice-President, William Gesner; Treasurer, W. J. Biggerstoff. A corps of engineers will be put in the field at once to survey the proposed route from Clear Lake to some point on the San Francisco & North Pacific road about 20 miles from Lakeport. The company will ask the citizens of Lake county for a subsidy.

Detroit Belt.—The company has been granted a charter to build a belt road around the city of Detroit. The capital stock is placed at $2,000,000. The following are stockholders: W. J. Spicer, E. W. Meddaugh, E. E. Driggs, Francis Adams and Chas. H. Muir, of Detroit; Jas. How and Chas. M. Hoyt, of St. Louis.

Duluth, South Shore & Atlantic.—Henry & Balch, of Minneapolis, who have the contract for building the line from Iron River to West Superior, Wis., about 30 miles, have completed the grading, and part of the track laying. The track on the remaining 15 miles of the extension will be laid by Nov. 15, and regular passenger service over the new route will begin Dec. 1. During this winter trains will probably enter Duluth over the St. Paul & Duluth via West Duluth.

Duluth Transfer.—The company expects to open for traffic on Dec. 1 next nine miles of main track and four miles of sidings, most of this having been built during the present year. The road is being built as a terminal freight and switching road for the purposes of supplying terminal facilities to new roads entering Duluth and to the manufactories, mills, elevators, etc., located on the north side of the Bay of St. Louis, and to aid the development and the business interests at the head of the lake. The industries already located on the line include saw mills, stone yards, two iron works and a large coal dock of the Pennsylvania & Ohio Coal Co. Connections are now made with the Northern Pacific and the St. Paul & Duluth, and by Dec. 1, connection will be made with the Duluth & Winnipeg. The tracklaying will cease for the winter this month, but the officers state that it will be resumed as early in the spring as practicable. The line extends along the lake front from Duluth to St. Louis Bay and St. Louis River. D. K. Smith, of Duluth, is President and General Manager.

Fifth Ward Transfer.—The franchise granting certain privileges and right of way in the city of St. Paul has at last been passed and accepted by the company. The principal condition is that the company shall build within the state of Minnesota, before Dec. 1, 1894, 50 miles of railroad.

Fitchburg.—The company is now engaged in laying a second track on the Watertown branch over its whole length, 6½ miles, from West Cambridge to Waltham, Mass., as already reported. This work is done entirely by day labor, a large force being employed, but it is difficult to get at the exact number of men employed on the work, as it is mixed in with other work near by, and the number of men varies every day. The work is very light, as the necessity for this track has been foreseen, and all the bridges except one small plate girder span of about 30 ft. have been built for double track. About ¾ of a mile of the new track is in use, and by Jan. 1, it is hoped to have 2½ miles more ready. In connection with this work, it has been found necessary to entirely reconstruct the junction switches at West Cambridge, and to move the interlocking signal tower to a more convenient position.

Geneva & Van Ettenville.—This line will be opened for traffic about Dec. 4 over the entire length of road from Geneva south to Van Ettenville, N. Y., a distance of about 51 miles. The line forms part of the new Buffalo extension of the Lehigh Valley. It begins at Van Etten, N. Y., about 15 miles north of Sayre, Pa., and connects at Geneva, N. Y., with the Buffalo & Geneva, the western end of the new extension. The greater part of the line is along the eastern shore of Seneca Lake through Lodi, Ovid, Willard and other towns. The line is double track for its entire length. Pending its completion, the Buffalo trains on the road have been running over the Ithaca branch.

Grand Trunk.—Notice is given that application will be made to the Privy Council, at Ottawa, for authority

to build a branch from a point on the main line in Montreal to the Village of Cote St. Paul, in Hochelaga County, Que.

Green Bay, Winona & St. Paul.—James Walker, Jr., of New York, vice-president of the road, is now in the West and states that the construction of the St. Paul extension will be begun early in the spring, and will be completed next summer. The surveyed route is from a point two miles east of Alma Center, through Durand and Black River Falls to St. Paul, a distance of 113 miles. A company was incorporated during the summer to build this road.

Hamilton, Grimsby & Beamsville.—At a recent meeting of the City Council of Hamilton, Ont., an application was received from the projectors of this road asking for a bonus of $50,000. The projectors want a by-law submitted to the people, so that it can be voted upon at the municipal elections in January. Secretary Rutherford says that, if the by-law is carried, the road will be built by June 1 next.

Helena & Southern Montana.—Ex-Governor S. T. Hauser and S. H. Hershfield, of Helena, Mont., the principal local projectors have recently returned to Helena after a short trip to New York to make financial arrangements for the building of the road. They propose to return to New York City in a few weeks and they tell the local newspaper men that they have no doubt that they will be able to conclude the negotiations begun on their first trip for the funds to build the road from Helena to the Castle Mountain district in Southern Montana a distance of about 80 miles.

Illinois.—A company of this name has filed articles of incorporation, proposing to construct a road from Chicago to the eastern boundary line of Illinois, near the south boundary line of Cook County, also a line from Chicago to a point near Rock Island. The directors are James Caldwell, George F. Watson, J. C. Reynolds, Edwin L. Waugh and William Dallin, all of Chicago.

Iron Range & Huron Bay.—The main line of the road from Huron Bay south to Champion, Mich., a distance of about 32 miles is now in operation, the track having been laid this fall by the company's forces. A new survey is now being made for the proposed line to Ishpeming, Mich., a distance of about 20 miles, and it is said that this line will be completed in the spring.

Jacksonville, St. Augustine & Indian River.—About 30 miles of track has been laid on the extension south of Daytona, the present end of track being at the head of Indian River, above Titusville. About 600 men are now at work on the extension, the greater part of this force being engaged on the tracklaying. The grading is practically completed for the entire 65 miles south of Daytona to Rock Ledge, Fla. The first 15 miles to New Smyrna is in operation, and the entire line will probably be opened for traffic early this winter. The extension is along the east coast of Florida near the Halifax River to Oak Hill, and along the west shore of Indian River from a point above Titusville through City Point and Cocoa to Rock Ledge, Fla. The survey is now being made for a line to Melbourne, 24 miles south of Rock Ledge. Louis McLain, C. E., of Sanford, Fla., is the principal contractor, his present headquarters being at Titusville. The work has been very light, the maximum grade being 26 ft. to the mile and the curvature six degrees. This road was formerly known as the Jacksonville, St. Augustine & Halifax River, but since the extension to the Indian River the name has been changed as above. H. M. Flagler, of New York, is President; W. L. Crawford, of St. Augustine, Fla., General Superintendent, and Charles O. Haines, of Titusville, Fla., Chief Engineer.

Kansas City, Nevada & Fort Smith.—L. J. Smith, American Bank Building, Kansas City, Mo., contractor for the extension south to Pittsburgh, Kan., 53 miles from Hume, will sublet contracts at once for the section from Clayton, Mo., to Pittsburgh, 35 miles.

Kickapoo Valley & Northern.—An arrangement for the operation of this line by the Chicago, Milwaukee & St. Paul is reported to have been recently agreed to. The new road was built last year from Wauzeka on the north bank of the Wisconsin River connecting with the Chicago, Milwaukee & St. Paul north through the Kickapoo Valley to Soldiers' Home about 25 miles. The opening of the line has been delayed chiefly because of the damage done to the new roadbed by the heavy rains last spring.

Mexican Southern.—The opening of this road through to Oaxaca, Mex., was made the occasion of a three days' festival for the city. President Diaz of Mexico, several of his cabinet ministers and many other high government officials were present. The road is controlled by an English company and has been building for about three years, the contractors being Read & Campbell of the City of Mexico. The road is a narrow gauge line extending from Puebla south to Oaxaca a total distance of about 367 kilometres or about 225 miles. The principal stations are Tehucaan, 75 miles south of Puebla add Tecomavaca about 60 miles south of the latter town.

Minneapolis, St. Paul & Sault Ste Marie.—The progress of the building of the Northwestern extension from Valley City, N. D., to the Canadian boundary line, has been referred to in these columns at various times. The following remarks concerning this line, attributed to President Van Howe, of the Canadian Pacific, are of interest: "The extension begins at Valley City, 287 miles from Minneapolis, and will extend through the counties of Barnes, Stuttsman, Foster, Wells, Church, McHenry, Ward, Renville and Montraille in North Dakota, or about 260 miles to the Canadian border, to which point the Canadian Pacific will build from Regina, Man., about 60 miles, and this completed there will be formed the shortest line from Minneapolis and St. Paul to the Pacific coast. The new line crosses the Great Northern at Minot and the Northern Pacific at Carrington. We expect to reach the latter point this year and complete the extension by August or September of next year."

Missouri, Kansas & Eastern.—This road, which is the St. Louis extension of the Missouri, Kansas & Texas, will be graded from New Franklyn to St. Charles, Mo., by Dec. 15. The track has been laid from St. Charles west to a point opposite Hermann, and also from Cedar City east five miles, and the sections will be connected Dec. 8. Track will be laid on the entire road by Jan. 15 next, and the road opened Feb. 15, 1893. Henry & Balch are doing the grading and bridging, and the Southwestern Co. the tracklaying by D. M. Wheeler, Assistant Superintendent, who is putting down three miles a day. The road follows the north side of the Missouri River with a practically level grade and with light curvature; one short tunnel and 230,000 yds. of solid rock being the heaviest work. It is being well constructed, making the best new road in the southwest, and its builders declare that it will be a paying road from its opening. C. E. Simmons, of St. Louis, is President, and F. N. Finney, Milwaukee, Superintendent, of the Southwestern Construction Co., which is building the line. R. P. Van Deusen is the engineer in charge of the construction of the line, with headquarters at Jefferson City, Mo.

Montreal & Pacific Junction.—The organization of the company was effected in Montreal, Que., last week. At a meeting of the shareholders held at the Jacques Cartier Bank, Montreal, the following board of directors was elected: Hon. A. Desjardins, President; Ald. R. Prefontaine, M. P., Vice-President; Messrs. C. T. Vian, M. Perrault and J. P. Casgrain, directors. The line, is to start from Hochelaga and pass through Bout de L'Ile to a point on the Canadian Pacific near L'Assomption, and will be located at once under the direction of the chief engineer, J. P. Casgrain, and it is expected will shorten the distance between Montreal and Quebec by about 12 miles. It is also intended to build freight branches to the factories along the wharves. The capital of the company is placed at $500,000.

Montreal & Western.—The roadbed of this road is now completed as far as Black River, Que., 52 miles beyond St. Jerome. The ties are in position as far as the 45 mile and the surveys are made to Chute aux Iroquois, the northern terminus.

Nelson & Fort Sheppard.—Grading will be begun in early spring on this road in British Columbia. The Pend d'Oreille River will be bridged before the water rises and the work pushed through to a finish. Engineer Roberts expects to have locomotives running to Nelson, B. C., by September of next year. The station will be located near the Columbia & Kootenay station and the lines will be connected. The route is from Fort Sheppard on the main line of the Canadian Pacific south to Nelson, B. C., in the Kootenay mining region.

New Roads.—It was announced that surveys would be begun this week for the proposed new road to Cape May which, is to start from Landisville, on the Jersey Southern. It is believed that the line can be constructed at a small expense. Considerable support has been given to the project in Cape May County, where the people have subscribed several thousand dollars already.

Oconee & Western.—The reorganization of the Empire & Dublin, which was purchased early in the fall at foreclosure sale by A. E. Hachfield and others, of New York, has been finally completed. A new company has been organized under the above name and arrangements made for building the road as originally projected when construction was begun in 1891. The road is already built from Hawkinsville northwest to within eight miles of Dublin, Ga., and is graded from Hawkinsville to Grovania on the Georgia Southern & Florida. The company will at once complete the road into Dublin and then from Hawkinsville to Grovania. There has been some delay in the matter in order to obtain the necessary charter powers from the legislature for the new company to make the financial arrangements necessary to do the work. The legislature is now in session and the matter of a charter will be soon arranged. A. E. Hachfield, No. 7 Pine street, New York City, is President; Claud Estes, of Macon, Ga., is Vice-President, and J. W. Hightower, of Empire, Ga., is General Manager and Superintendent.

Ottawa, Arnprior & Parry Sound.—The grading from Ottawa, West to Arnprior, Ont., is almost completed. The timber for the trestle crossing in the township of Nepean is all ready and work will go on at once. It is expected that in ten days or two weeks the work of laying the rails will begin. The trestle work across the track of the old St. Lawrence & Ottawa is being pushed along. The Privy Council at Ottawa has refused to sanction a grade crossing of the Canadian Pacific, and it is stated that an overhead crossing will cost $40,000.

Ottawa & Gatineau Valley.—A surveying party has gone out to locate the route of the road from five miles above Kazabazua to the Desert, Que., the terminus, a distance of about 40 miles. The road is now built to Kazabazua and ballasted to within seven miles from that place. It is expected it will be opened for traffic from Fanelton to Kazabazua by January. Next summer work will be pushed on an additional 20 or 30 miles.

Owensboro, Falls of Rough & Green River.—R. R. Hathaway has, it is reported, been awarded the contract for building the road from the Louisville, St. Louis & Texas to its terminus at the head of Main street. Contract has also been awarded to Joseph Crahan for grading and filling from Carter's cut to Barrett's ferry, east of Fordsville.

Orford Mountain.—The construction of this road between Eastman and Kingsbury, Que., is being pushed, and the rails are now within a few miles of Kingsbury. The station at Kingsbury is being built and the road will be in running order this month. Last week, Messrs G. Stevens, Managing Director and G. C. Foster, of Montreal, Chief Contractor, went over the line from Eastman to Richmond, Que., to arrange for the building of the telegraph line.

Pennsylvania.—Work has been begun on the double track branch road, one mile in length, which will extend from the Germantown & Chestnut Hill branch of the Pennsylvania to the Midvale Steel Works, at Nicetown, Pa. The branch, though short, will be expensive, as it passes through valuable property before reaching the land of the Midvale works. All grade crossings will be avoided.

Quaker City Elevated.—A meeting of the board directors and stockholders was held at the general offices in the Girard Building, Philadelphia, last week, were General James Jurdan, President of the Kings County Elevated Road, of Brooklyn; W. A. Reed and W. C. Bull were the New York directors present. The plans of construction were approved by the directors, and a contract for the work of construction was awarded to the Penn City Construction Co. George Boker was added to the Board of Directors.

St. Louis, Chicago & St. Paul.—The survey of the St. Louis extension has been made, and the contract for building the line has been let and work has already been commenced. With a continuance of the present fair weather trains will be running into St. Louis in the near future. In addition to the work on this line, the first survey of the projected line from Springfield to Peoria, Ill., has been completed, and at the present time the engineers are in the field again, looking over the line surveyed between Springfield and Peoria, preparatory to locating, and the contract will be let at as early a date as possible.

State Line.—The work on this road between Morgantown, W. Va., and Uniontown, Pa., still continues to make good progress. The road is being built by the Baltimore & Ohio and when finished, will give the company a short line between Fairmount, Marion County, W. Va., on the Wheeling and Grafton Division, and Connellsville, Pa., on the Pittsburgh Division. From Uniontown to Red Stone, Pa., the road is completed and in operation; and between Red Stone and Smithfield the track is laid and after a little more ballasting will be ready for use. Between the latter place and Point Marion, Pa., the grading is being done as rapidly as the weather will permit. When opened for traffic the new road will save more than 100 miles of travel from Pittsburgh and Connellsville to Fairmount, W. Va. The line is 70 miles long between Connellsville and Fairmount, but 40 miles of this distance is included in old branches. The through line will be opened about May 1, 1893.

Silver Creek & Dunkirk.—Freight trains are now running over this road, which has been building for nearly two years, between Dunkirk and Silver Creek, N. Y. It is a low grade cut-off of the Lake Shore & Michigan Southern and is about nine miles long. The construction work has been very heavy and expensive as it was necessary to do considerable hill excavation near Silver Creek, build a number of masonry bridges and a trestle across part of the lake.

Southern Pacific.—C. P. Huntington, A. N. Towne and other leading railroad officers have just made an inspection over the line of road which has just been completed for a distance of 30 miles south of Bakersville, Cal., through the Kern Valley to the asphaltum beds which extend along the western base of the Coast Range for a distance of 30 miles. It is understood that the purpose of the visit of Mr. Huntington was to ascertain if further extensions were necessary to reach the asphaltum and oil fields, and it is said that he has decided to commence work on extensions to San Miguel, on the coast line, and to Armona, Cal.

Taylor Coal & Mining Co.—This company is having surveys made for a road about 2½ miles long from McCuneville, on the Baltimore & Ohio, to the company's coal lands in Perry County, O. The company has not yet made any contracts except for right of way. The road is very easily constructed, as the survey follows the roadbed of an old road used eight years ago for transporting iron ore from the coal track to McCuneville. The Baltimore & Ohio will probably lay the tract when the road has been graded and ties laid. Walter Dickson is President and J. Owen Moore, Vice-President, and W. H. Taylor, Secretary and Treasurer, with office at 54 Bible House, New York City.

Tehuantepec.—The steamer Bawnmore has unloaded at Salina Cruz 2,000 tons of rails and fastenings and two locomotives. Piles are being driven for the Naranjos bridge on the northern division, and work is being pushed along the entire line.

Unadilla Valley.—A number of the directors and others interested in the building of the road left New York City last week to go over part of the line between New Berlin and Bridgewater, N. Y., on the Delaware, Lackawanna & Western. The party included William Forster, President of the road and Vice-President of the John Kress Brewing Co.; E. A. Quintard, Vice-President of the road and President of the Citizens' Savings Bank; Robert Dunlap, James T. Sparkman, Vice-President of the New York & New Jersey Bridge Co.; J. D. Sparkman, Michael Coleman, ex-Tax Commissioner of New York City; Samuel H. Ordway, of the firm of Stickney, Spencer & Ordway, New York; Clarence Goodby, Treasurer of the American Savings Bank, and George B. Rhodes, President of the Stuyvesant Insurance Co., all of New York, and the officers of the company, F. F. Culver, W. S. Skidmore, Secretary; R. Floyd Clarke, Counsel and M. L. Davis, Resident Engineer. The track has been laid 1¼ miles out of Bridgewater, while the grading has been completed about five miles beyond Leonardsville, near West Edmeston. About 75 men have been at work this fall on the culverts and cattle guards near Bridgewater, and getting the track ready for the rails as far as the grading is completed. Several carloads of rails are now at Bridgewater, and several more are expected this week. The work will be carried on during the winter, and the officers expect to have the road in operation by July next between Bridgewater and New Berlin, 10¾ miles. Freight trains will begin running from Bridgewater south to Leonardsville next month.

Union Pacific.—A number of changes in the location of the northern part of the Utah Northern are proposed, and it is expected that the plans will be carried out early next spring. One of the first changes that will be made will be the elimination of the two reverse curves between Dillon and Silver Bow near Butte, Mont. This work will necessitate the construction of a tunnel through the mountains between points.

United Counties.—E. P. Quirk, Chief Engineer, reports that on the line between Iberville and St. Hyacinthe, Quebec, the road has been graded for 17 miles, that is, from Rouville to St. Hyacinthe. On eight miles of the distance the rails are laid. The grading is going on from Rougemont to Ste. Angele, where the road is to connect with the Montreal, Portland & Boston. By December the company will have 20 miles of the road ready for traffic. The remaining 10 miles will be completed next summer.

Wabash.—The new Detroit-Chicago line, now building will be opened for traffic between Montpelier, O., and Wolcottville, Ind., this week. Trains will leave Montpelier at 8 a. m., and 4:40 p. m., and Wolcottville at 12:30 p. m. and 6:40 p. m. The intermediate stations are Edon, Hamilton, Ashley and South Milford.

Wilmington, Onslow & East Carolina.—The location has been about completed for the extension from Jacksonville northeast to Newberne, N. C., and it is now expected that the construction of the line will be pushed to completion without further delay. The road has been located through Hayesville and Pollacksville to Newberne on the Atlantic & North Carolina, and 15 miles of the line has been graded for some time. At present about 250 men are at work. Thomas A. McIntyre, 212 Produce Exchange, New York, has the contract for the extension which is being built under the charter of the East Carolina Land & Railway Co. The officers are practically the same as those of the above company. Ewen McIntyre, Sr., 212 Produce Exchange, New York, is President; H. A. Whiting, Wilmington, N. C., General Manager, and Foster B. Morse, Wilmington, is Chief Engineer.

GENERAL RAILROAD NEWS.

Canada Coal & Railway Co.—The plans for the development of the coal lands and other property in Nova Scotia are about completed and active operations will soon be commenced under the direction of H. F. Touey, formerly Mining Engineer for the Delaware & Hudson Canal Co. The present company some time ago purchased the property of the Joggins Coal Mining Association, including the Joggins railroad, extending from Maccan, N. S., on the Intercolonial, to Joggins Mines, 12 miles.

Canadian Roads.—The Attorney General of the Province of Nova Scotia has been at Ottawa endeavoring to come to terms with the Dominion Government regarding the railroad question in dispute. A refund is claimed of $2,000,000 from the Dominion, which Nova Scotia expended in building certain railroad connections, which are now included in the Intercolonial, operated by the Dominion Government. These lines are the Eastern Extension from New Glasgow to Cape Canso and which was subsidized by the Province to the extent of $671,000, and also the Western Extension, was bonused by the Province to the amount of $679,000. Both of these roads are now part of the Intercolonial. In addition there is the branch extending from Annapolis to Yarmouth, an extension of the Windsor & Annapolis, which got a subsidy of $679,000 from the Province. In 1887 the Dominion Parliament passed an act declaring this road, including the extension, to be a work for the general advantage of Canada, by taking it out of the Provincial control and completing it.

Fonda, Johnstown & Gloversville.—The New York Central & Hudson River road is reported to have purchased the majority of the stock of this road. It is a local line connecting with the New York Central at Fonda, N. Y., and extending north through Gloversville to Northville, 26 miles.

Great Northern.—The company has inaugurated mixed train service between Spokane and Wenatchee, Wash., 173 miles. This extension of train service opens 17 new stations on the line of the Pacific extension, which is expected to be completed to the coast by November 30.

Hamilton & Northwestern.—A case of some importance in connection with the bonusing of railroads in Canada came up in the Supreme Court at Ottawa last week, on appeal. It is an action brought by the county of Halton, Ont., against the Grand Trunk upon a bond given by the old Hamilton & Northwestern to the county in the sum of $100,000, guaranteeing among other matters that if at any time within 21 years the road ceased to be an independent line, the company would pay back a bonus of $65,000 which the county contributed to build the road. The Hamilton & Northwestern became part of the Grand Trunk system some years ago. The county of Halton therefore brought this action against the Grand Trunk to recover the $65,000. Judgment was given at Toronto in favor of the county for $70,381, the increased amount representing interest. The Grand Trunk appealed to the Common Pleas Divisional Court and judgment was again given for the county. In the Court of Appeal to which the case was again carried the former judgments were sustained. Not content with this the company carried the case to the Supreme Court.

Mobile & Girard.—Charles L. Pollard, of Montgomery Ala., has been appointed Receiver in a suit brought in the United States Court by some of the stockholders. The road is operated by the Central of Georgia, and extends from Columbus, Ga., south to Sea Wright, Ala., about 125 miles. The 45 miles south of Troy, Ala., was built in 1891 and 1892. The Receiver has not yet taken possession of the property, because the rolling stock is held by the Central of Georgia. A suit has been begun against Receiver Comer of that road to compel him to surrender the equipment claimed by the road.

Montreal & Sorel.—The appeal to the Supreme Court to prevent the sale of the road has been dismissed and a petition will be presented in court immediately to obtain the necessary authorization for the sale. The repairs on the line between Vercheres and Sorel, Que., were finished this week and the contractors expect that trains will be able to run between Montreal and Sorel by Dec. 1.

New York Central & Hudson River.—The following is a statement of earnings and operating expenses for the three months to Sept. 30:

	1892.	1891.	Inc. or dec.
Gross earn.	$12,066,596	$11,887,987	I. $178,609
Oper. expen.	8,398,521	7,657,003	I. 741,518
Net earn.	$3,668,075	$4,230,984	D. $562,909
Fixed charges	2,508,219	2,466,929	I. 41,290
Profit	$1,159,855	$1,764,055	D. $604,120
Dividend	1,117,854	1,117,854	
Surplus	$42,001	$646,201	D. $604,120

Tennessee & Coosa.—A bill for a receiver for this road, which is the property of the Nashville, Chattanooga & St. Louis, has been filed in the United States court at Birmingham, Ala. The road between Gadsden and Attalla, Ala., 11 miles, was purchased last year, and a new line is being constructed from Attalla to connect the line with the Huntsville division.

Toledo, St. Louis & Kansas City.—A special meeting of the preferred shareholders was held at Toledo, O., Nov. 15, to vote upon the question of placing a mortgage of $13,500,000, consent for which was asked by the management. More than three-fourths of the preferred stock was represented and a large majority of shares was voted against the proposition. The preferred stockholders were the first mortgage bondholders of the old company, and they were opposed to placing a new mortgage ahead of the preferred stock.

Union Pacific.—The September statement of earnings given below shows a gain of about six per cent. in gross earnings, and an increase in operating expenses of nearly eight per cent.:

September:	1892.	1891.	Inc. or dec.
Gross earnings	$4,585,218	$4,319,050	I. $266,168
Operating expenses	2,542,751	2,335,565	I. 211,186
Net earnings	$2,038,467	$1,983,485	I. $54,982
Nine months ending Sept. 30:			
Gross earnings	$ 2,388,931	$31,165,308	I. $1,223,333
Operating expenses	20,744,122	20,826,771	D. 82,649
Net earnings	$11,644,809	$10,338,627	I. $1,306,182

Washington & Columbia.—Pursuant to an order of the United States district court for Oregon, the property of the Oregon & Washington Territory Railroad, which has been in the hands of a receiver since Dec. 1891, was transferred on Nov. 4 to this company organized by the purchaser at foreclosure sale to operate the road. The capital stock is owned almost entirely by C. B. Wright, of Philadelphia, who owns all the bonds of the road, amounting to $4,175,000. W. P. Tyler, of Tacoma, is President, and C. B. Wright Jr., of Walla Walla, Wash., is General Manager.

TRAFFIC.

Traffic Notes.

Eastbound shipments via Omaha for the month of October amounted to 7,026 cars, distributed as follows: Burlington, 1,908; St. Paul, 1,276; Northwestern, 2,114; Rock Island, 708; Chicago, St. Paul, Minneapolis & Omaha, 130; Chicago Great Western, 2; Hannibal & St. Joseph, 152; Missouri Pacific, 260; Wabash, 476.

Eastbound carload shipments through Southwestern Missouri river gateways for the month of October were 23,027 cars, distributed as follows: Alton, 2,641; Burlington, 3,887; St. Paul, 1,690; Rock Island, 2,718; Santa Fe, 4,677; Chicago Gt. Western, 1,793; Wabash, 1,731; Mo. Pacific, 2,454; Kansas City, Ft. Scott & Memphis, 1,436.

The railroads of Canada, acting in conference, have decided that on and after Nov. 14 they will make a charge for collecting, and a like charge for delivering freight at all stations, where they have hitherto performed this service [free], of 1¼ cents per 100 lbs. on goods in first, second, third and fourth classes, in addition to the published tariff rates.

In the United States Circuit Court of Appeals, at Philadelphia, last week, Judge Dallas decided that Frank W. Fowkes, the Second Assistant General Freight Agent of the Philadelphia & Reading, need not go to St. Louis to stand trial for an alleged violation of the Inter-State Commerce law. Mr. Fowkes was indicted several months ago in connection with a suit about irregular rates on certain freight shipments from St. Louis to New York.

The petty stealing of wheat from cars in the railroad yards at Minneapolis has become so annoying that representatives of the railroads, the State Railroad and Warehouse Commission and the Minneapolis Chamber of Commerce have adopted measures to prevent it. Under the plan adopted State sealers will be employed and stationed in each yard in the city. These sealers will be under the State Grain Inspection Department, and will break the seals of the cars when samples are desired, sealing them again when the samples have been taken out. The sealers will be vested with police power, and will arrest anyone not authorized who breaks the seals. In the future the sampling will be done by the employés of the Chamber of Commerce.

The competitors of the Union Pacific are demanding that it re-establish the through route via Ogden, and threaten that unless this is done they will discontinue relations with it via Omaha. The Burlington and the Rock Island endeavor, of course, to take all westbound business to Denver, and let it reach the Union Pacific there or further west (Ogden), but the Union Pacific tries equally hard to keep all eastbound business on its own line as long as possible and therefore delivers as little as possible to the Denver & Rio Grande at the Utah junction. The immediate bone of contention is the traffic contract between the Union Pacific and the Chicago & Northwestern, under which they maintain a through car service over those lines between Portland and Chicago. The Union Pacific naturally is unwilling to give up this arrangement, and offers as a reason for not doing so that the Ogden gateway was always a source of trouble on account of the facility afforded for scalping tickets.

A proposition has been made to reorganize the Ohio Coal Traffic Association, which is about to be disrupted by the withdrawal of the Columbus, Hocking Valley & Toledo and the Columbus, Shawnee & Hocking. The Association has existed since 1883. Up to the time the interstate commerce law took affect, the earnings of the roads in it were pooled. Since that time it has been merely an association for the maintenance of rates. President Waite, of the Columbus, Hocking Valley & Toledo, is quoted as saying that he has requested the other companies to present a plan for pooling the tonnage or any other arrangement that would be effective. The lake tonnage over the road this year has fallen off 150,000 tons, and that of other roads has increased correspondingly. The Cleveland, Lorain & Wheeling and Wheeling & Lake Erie companies practically mine their own coal, although they maintain separate companies; they are, therefore, able to undersell other operators in the market, and at the same time make the same transportation rates as other roads. President Waite proposes to protect the operators shipping over the Hocking Valley Road against this combination.

Chicago Traffic Matters.

CHICAGO, Nov. 16, 1892.

A committee from Western Freight Association lines were in session last week and Monday of this week considering plans for the distribution of competitive traffic and the maintenance of rates. Two plans were under consideration, both having for their object the equalization of traffic and the consequent maintaining of rates, by diversions, but the lines were not able to come to an agreement as to the details of either, and adjourned until Nov. 30.

The general managers have decided that sufficient grounds do not exist for keeping their freight houses open until 5:30 or 6 p. m., as requested by the Chicago merchants, and have therefore declined to grant the petition.

The Lake Shore & Lehigh Valley Fast Freight line has been opened for business, operating over the Lake Shore & Michigan Southern, the Lehigh Valley, the Philadelphia & Reading and the New York & New England.

The Atchison, the Burlington, the Rock Island, the Chicago Great Western, the Northwestern and the St. Paul roads have agreed to pay no more than $1 commission on passenger traffic to the Missouri River after Dec. 1, conditional upon the co-operation of other interested lines, which will probably be secured. This commission is to be paid only to the authorized agents of connecting lines.

The relations of the Nickel Plate and the Santa Fe are at present far from amicable, owing to the action of the former in issuing special prepaid ticket orders on the Santa Fe, which were disposed of to brokers. The trouble all arose through the carelessness of a clerk in one of the broker's offices here who inadvertently dated an order purporting to have been issued in Cleveland, the same day it was presented at the Santa Fe office in Chicago for a ticket. Thereupon the Santa Fe notified the Nickel Plate that the practice must be stopped. This not being done, orders were given to refuse the ticket orders of the Nickel Plate and the latter retaliated by "turning down" all Santa Fe business. The scheme was a neat one and might have been worked by the brokers indefinitely if the clerk had not made a slip in the date of the orders referred to. By means of these orders a cut of $5 was possible on California business, that being the agreed commission allowed the eastern connection on this business. The city agent of the Nickel Plate at Cleveland is quoted in a press telegram as saying that no orders were sold to brokers, except in connection with tickets to Chicago. This, however, does not explain how the blank orders came to be in the possession of Chicago brokers. As the legitimate business of the Nickel Plate is not very large the Santa Fe is likely to be the gainer by the "boycott."

The arbitrators in the so-called "Santa Fe case," Messrs. E. A. Ford, A. J. Smith and C. P. Atmore, have rendered a decision sustaining the Atchison, Topeka & Santa Fe. It will be remembered the case grew out of the action of that road in reducing rates to Denver for the conclave of Knights Templar, on the ground that an outside line (the Alton) was offering less than the agreed rates. The Chairman of the Western Passenger Association did not consider the proofs conclusive and refused his consent to the reduced rates. The Santa Fe took an appeal and put the rates in effect. The chairman then ruled that this action was a violation of agreement. The road appealed from this and set up a counter charge of "conspiracy" on the part of the chairman and other members because it (the Santa Fe) was not given a voice in the meeting which authorized the use of the $12 rate. The case became quite complicated, but finally resolved itself into a consideration of the two questions: (1) Was there a conspiracy between the chairman and other lines against the Santa Fe? and (2) Was the Santa Fe justified in reducing the rate?

The full text of the decision is as follows:

In the "Conspiracy" Case.—1. We find that the conspiracy is not proved as charged, but it is shown that the Santa Fe Company was unfairly treated (1) by the Chairman who gave it no voice in the matter of granting relief to its associate members, and (2) by its partners in the Association who based their application for relief upon the announced intention, as well as the warrantable procedure of the Santa Fe Company, one of its members, who was preparing to lawfully protect its interests under Article 9 of the Agreement, rather than upon the clearly established action which had already been taken by "a line outside of the Association" and by certain lines within the Association. 2. We find that the Chairman was not justified in granting relief to certain members of his Association to the exclusion of others, basing his decision upon the declared intention of the Santa Fe to protect its interests in harmony with the letter and spirit of the Agreement. He should have held the Santa Fe responsible for its action, exacting, if found guilty of a violation of the Agreement, the penalties distinctly prescribed therein. 3. We find that the Chairman's rulings were therefore in error.

In the "Justification" Case.—We find that the Santa Fe Company did present to the Chairman sufficient justification under Article 9 of the Agreement to warrant meeting "the action of a line outside of the Association" in offering less than agreed rates to Denver and return for the Knights Templar, and the decision of the Chairman is therefore reversed.

This disposition of the matter, although a defeat for the chairman, relieves him by averting the unpleasant consequences which were sure to follow an attempt to enforce the Association penalty had the decision been against the Santa Fe. No one believes the Santa Fe managers would have turned into the association treasury the revenue on this business, as required by the agreement, which would have left the chairman no alternative but to "read them out" of the Association, which, in the present strained situation, would undoubtedly have disrupted the organization.

The shipments of eastbound freight, not including live stock, from Chicago by all the lines for the week ending Nov. 12 amounted to 68,504 tons, against 74,569 tons during the preceding week, a decrease of 6,065 tons, and against 67,199 tons during the corresponding week of 1891. The proportions carried by each road were:

Roads.	W'k to Nov. 12.		W'k to Nov. 5.	
	Tons.	P. c.	Tons.	P. c
Michigan Central	10,671	15.6	11,708	15.7
Wabash	3,469	5.1	3,280	4.4
Lake Shore & Michigan South.	12,701	18.5	15,052	20.2
Pitts., Ft. Wayne & Chicago	8,070	11.8	8,980	12.1
Pitts., Cin., Chicago & St. Louis	7,902	11.5	9,382	12 8
Baltimore & Ohio	4,531	6.6	3,423	4.6
Chicago & Grand Trunk	4,137	6.1	5,167	6.9
New York, Chic. & St. Louis	7,010	10.2	6,781	9.1
Chicago & Erie	6,397	9.3	7,587	10 2
C., C., C. & St. Louis	3,616	5.3	3,050	4.0
Total	68,504	100.0	74,569	100.0

Of the above shipments, 2,941 tons were flour, 28,960 tons grain and millstuff, 10,441 tons cured meats, 10,722 tons dressed beef, 975 tons butter, 2,845 tons hides and 7,726 tons lumber. The three Vanderbilt lines carried 44.3 per cent., the two Pennsylvania lines 23.3 per cent. The lake lines carried 73,617 tons, against 82,447 tons during the preceding week, a decrease of 8,830 tons.

Parlor Cars on the Pennsylvania.

The Pennsylvania Railroad Co. has decided to abandon its own parlor car service on the New York division and substitute for it the Pullman parlor car service entirely. There are about 15 of the company's parlor cars on the New York division, and they will be withdrawn as soon as Pullman cars can be substituted. This conclusion was reached after several years' trial by the Pennsylvania officials of their own parlor cars. There was no financial loss incurred, but the number of cars was comparatively small, and the burden of a special department for such a small number did not compensate for the advantages to the company.—*Philadelphia Public Ledger.*

National Transportation Association.

This Association, consisting of delegates from various Boards of Trade throughout the country, especially those which maintain freight bureaus, held a meeting at Buffalo, Nov. 16 and 17. Col. Aldace F. Walker, Chairman of the Board of Commissioners of the West-Traffic Association, addressed the meeting on the subject of freight pooling. George R. Blanchard, of the Central Traffic Association, was to speak on Thursday morning. The officers of the Association are as follows: George M. Lane, of Detroit, President; W. S. Young, of Baltimore, Vice-President; George F. Stone, of Chicago, Secretary, and F. H. Magdeburg, of Milwaukee, Treasurer.

GEO. WESTINGHOUSE, JR., President. T. W. WELSH, Supt. JOHN CALDWELL, Treasurer. W. W. CARD, Secretary. H. H. WESTINGHOUSE General Manager.

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The best results are obtained in freight train braking from having all the cars in a train fitted with pow e brakes, but several years' experience has proven conclusively that brakes can be successfully and profitably used on freight trains where but a portion of the cars are so equipped. Below is a graphical illustration of the progress made in the application of the Automatic Brake to freight cars since its inception

Year.	No. per year.	Grand total
1881	105	105
1882	1,085	1,190
1883	4,966	6,156
1884	15,051	21,207
1885	10,410	31,617
1886	8,946	40,563
1887	9,281	49,844
1888	27,696	77,540
1889	26,065	103,605
1890	50,502	154,107
1891	39,061	193,168

193,168 freight cars fitted with the Westinghouse Automatic Brake, which is nearly 20 per cent. of the Entire Freight Car Equipment of this country.

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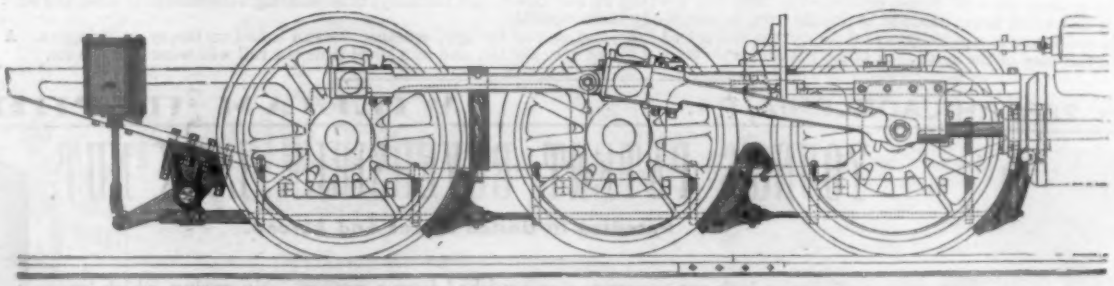

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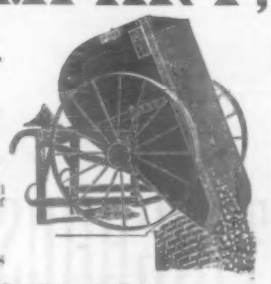

OFFICE OF UNION ROLLING MILL CO.,
CLEVELAND, O., Oct. 15, 1892.

The Akron Tool Co., Akron, O.:

GENTLEMEN: Referring to your letter of recent date, we would say that we were one of the first to use the McNeil Charging Barrow. In fact we believe we were THE FIRST to use them. We now have twenty-four of them and are very well satisfied with them. We can confirm the testimony of Sept. 16, 1890, a copy of which you have in your circular, after two more years' use of the Barrows.

Yours very truly, UNION ROLLING MILL CO.,
WILLARD FULLER, Supt.

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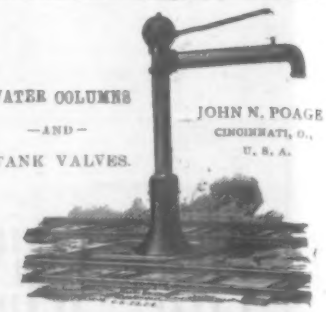

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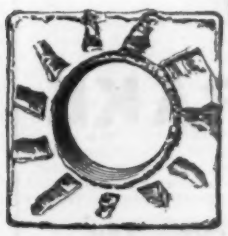

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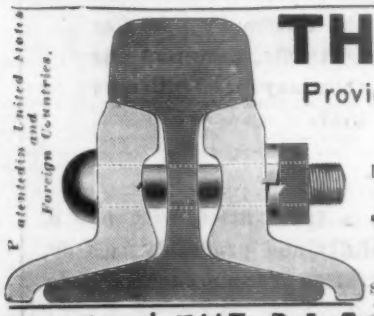

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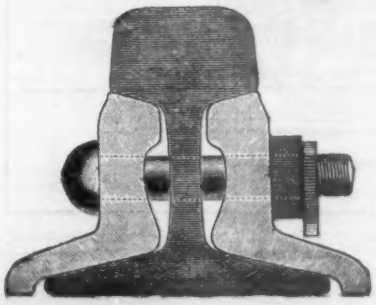

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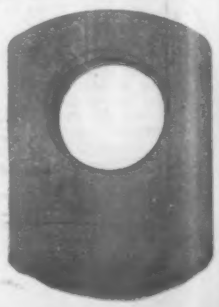

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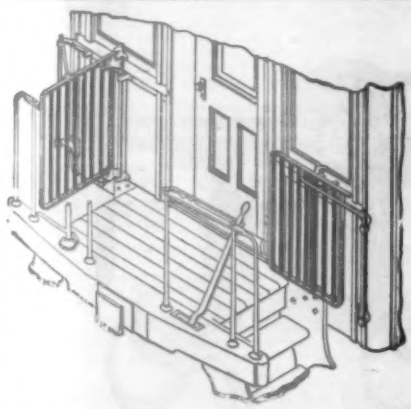

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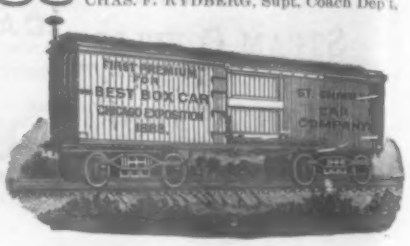

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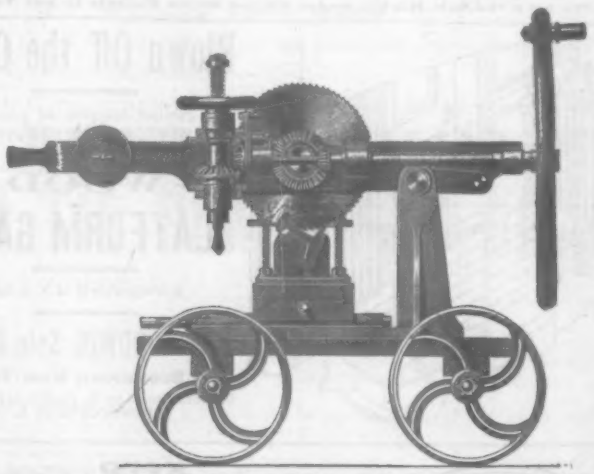
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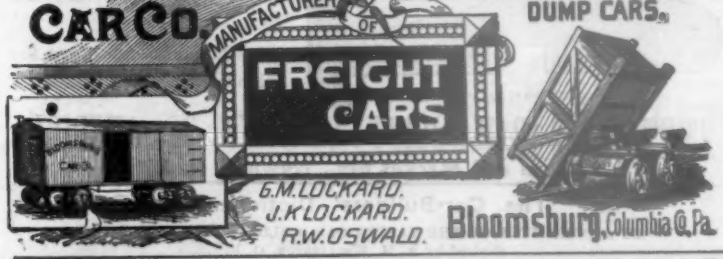
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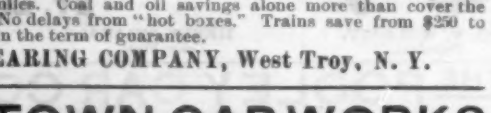

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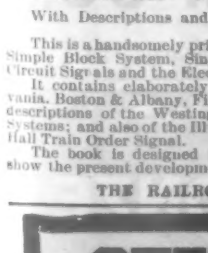

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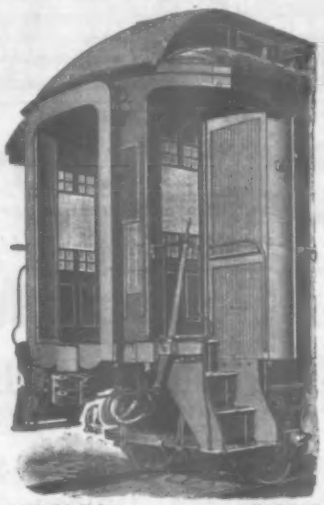

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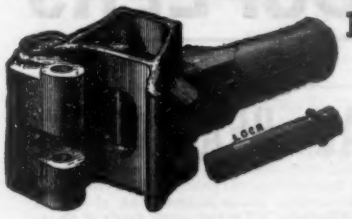

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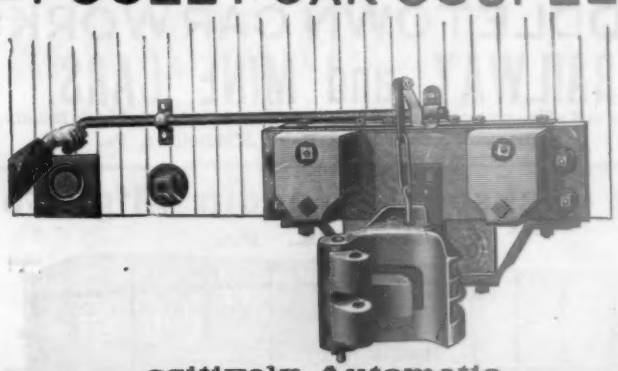

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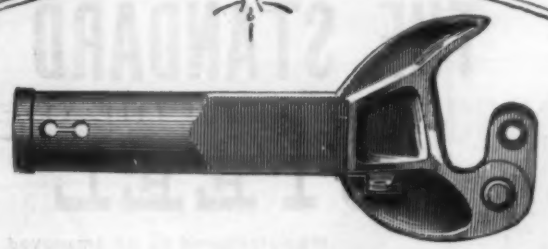

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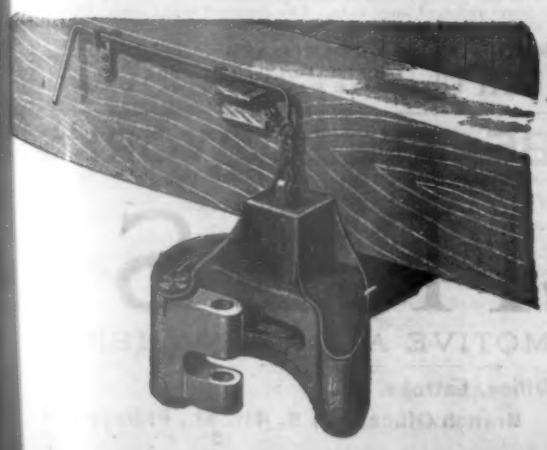

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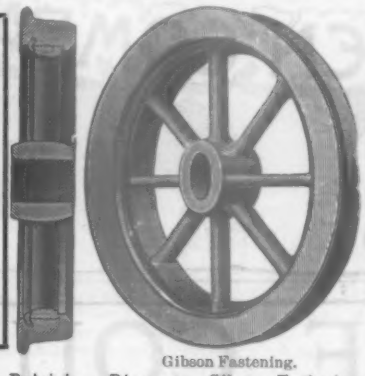

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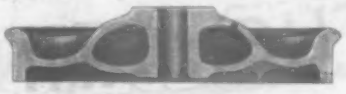

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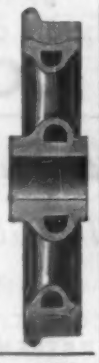

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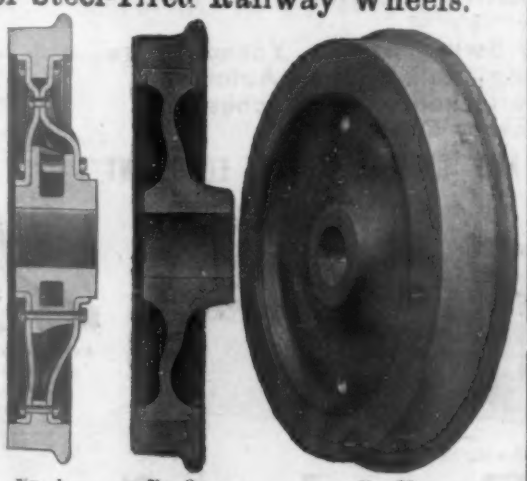

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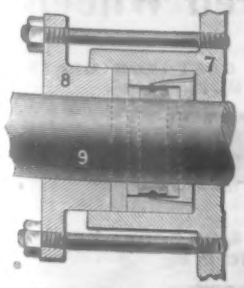

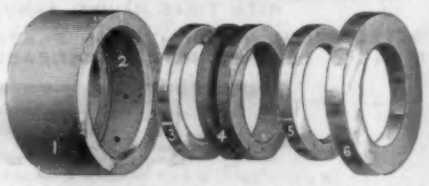

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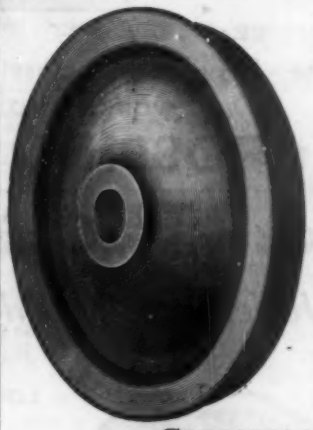

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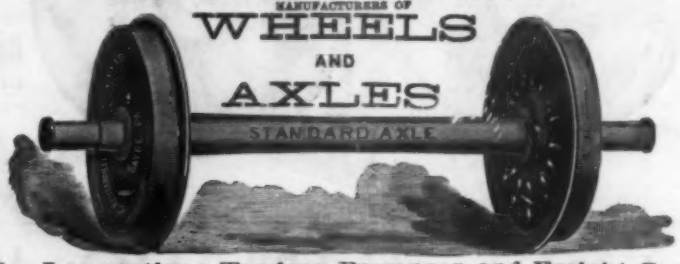

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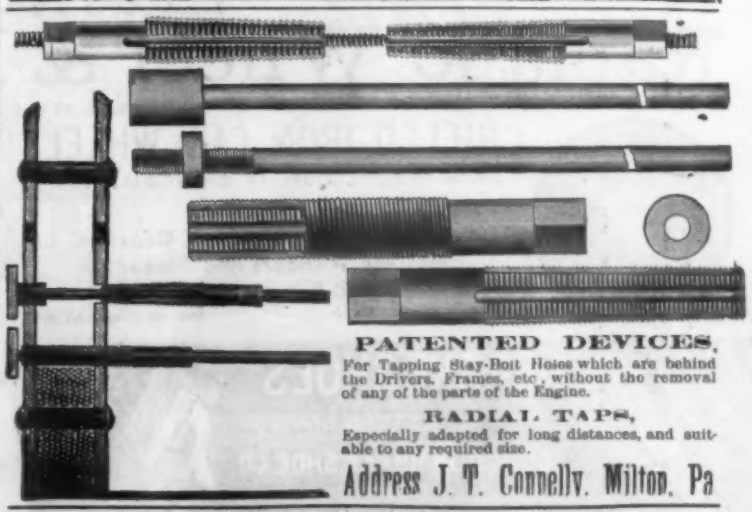

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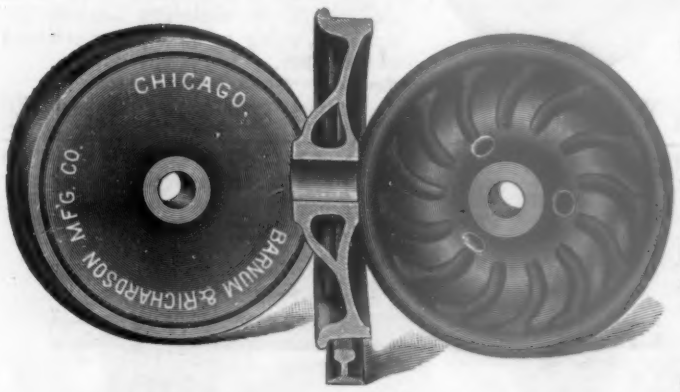

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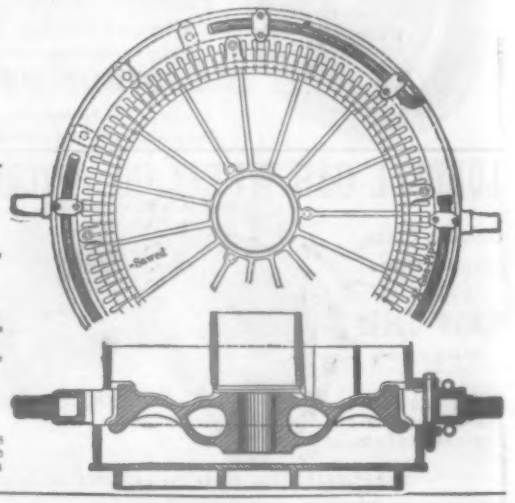

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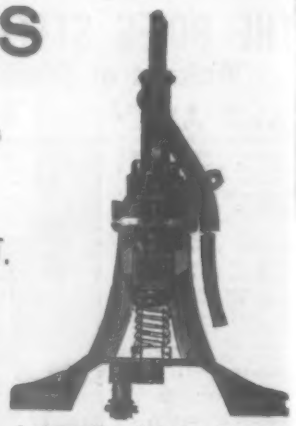

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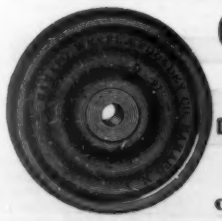

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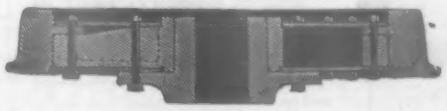

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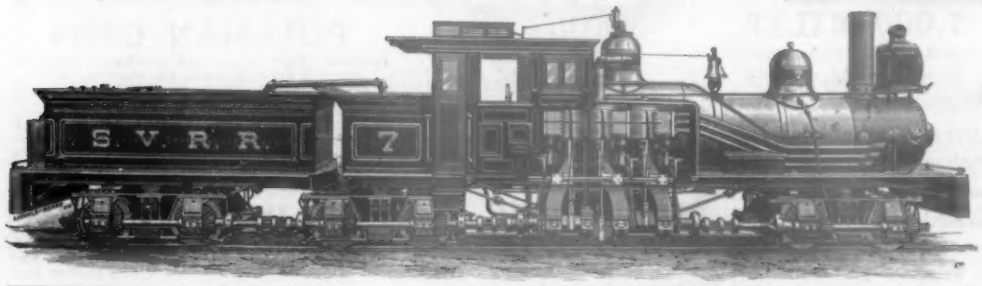

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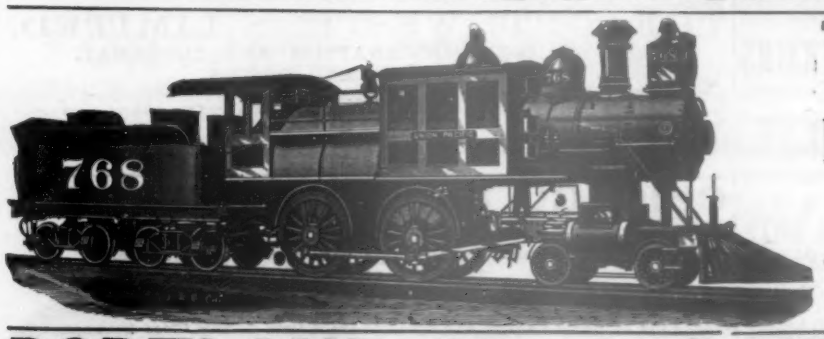

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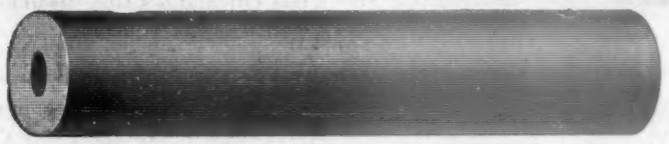

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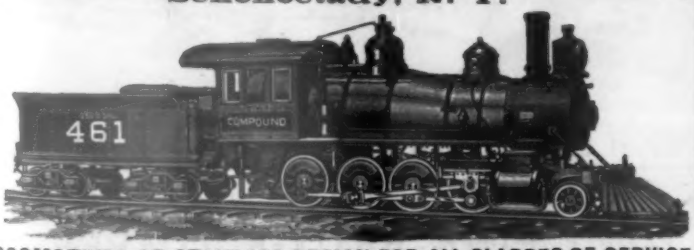

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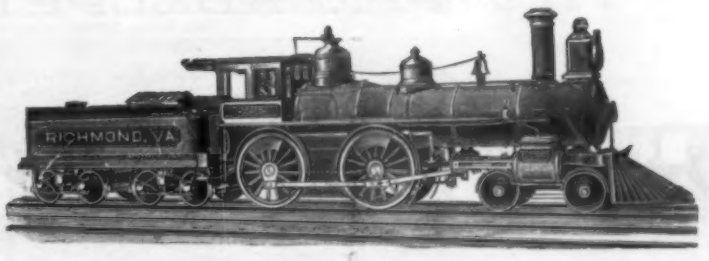

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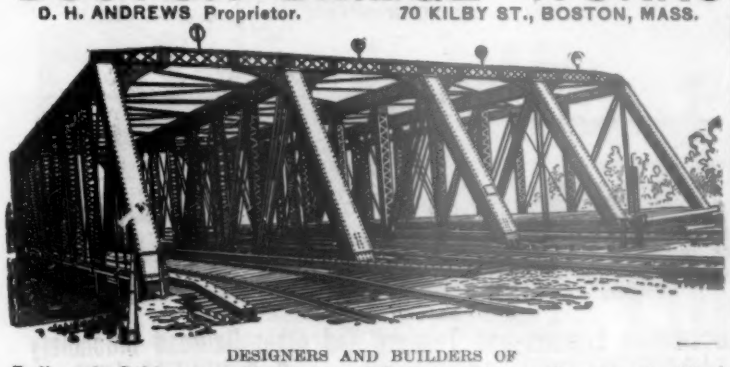

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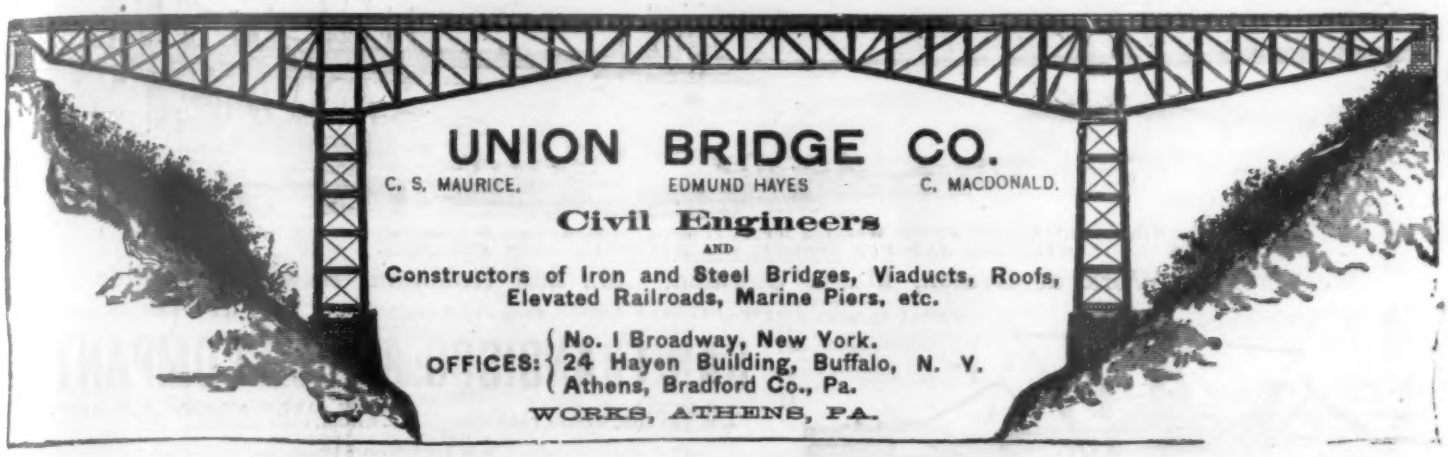

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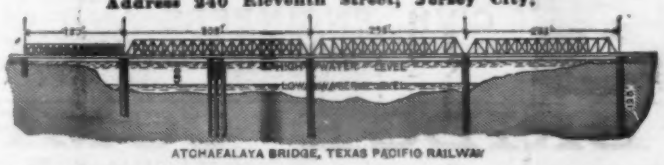

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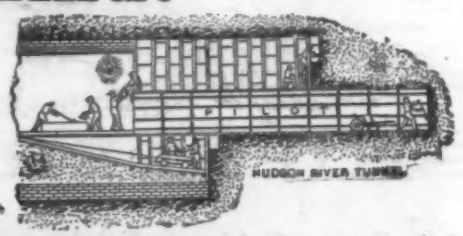

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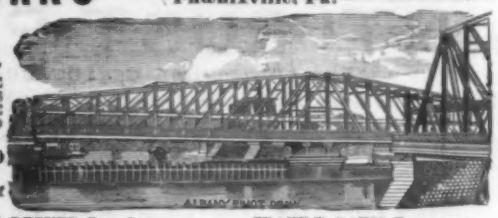

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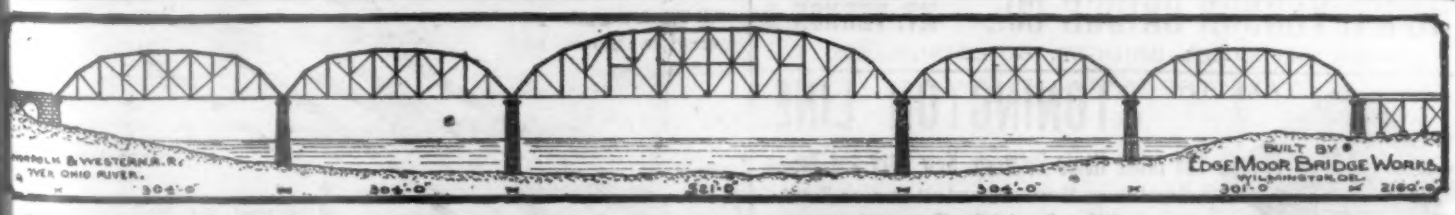

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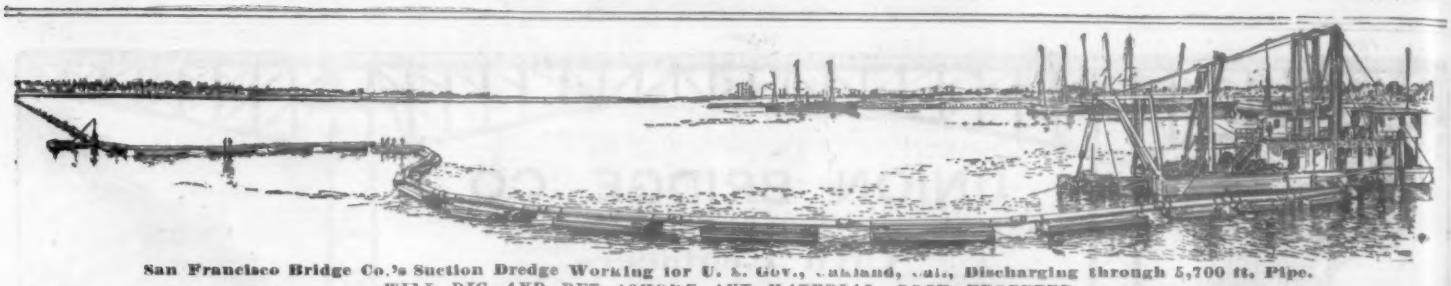

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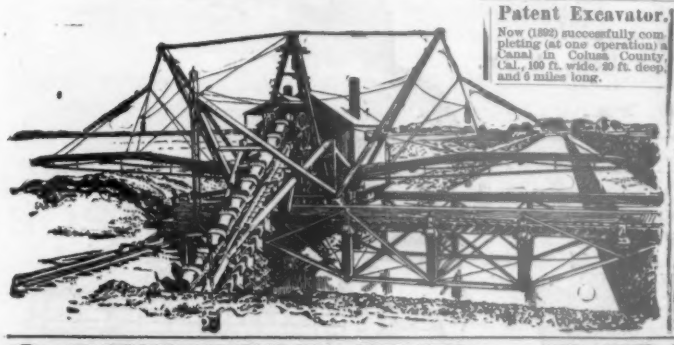

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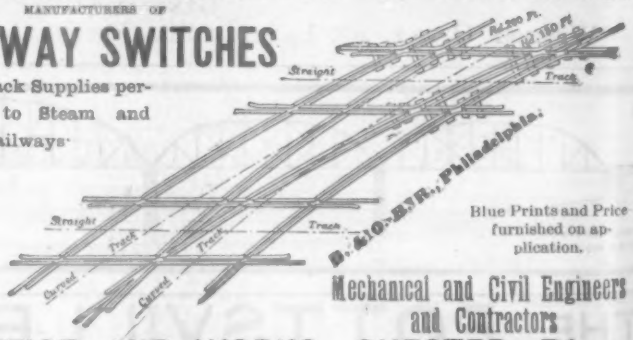

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Nov. 18, 1892.

MODEL

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5. Adam Blumer
5. Bridgeport C
7. Westinghouse
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7. Wm. Clark T
7. United Gas I
7. H. J. Russell
7. Evanston El.
7. J. E. Reinecke
7. Yuan Boyer
7. Yg. Y. Bertra
7. Jose Solderila
7. Jose Tobra
8. Rourke, Stro
10. Pittsbugh Red
10. "
10. Detroit Cliffs
11. Montgomery S
11. Columbian Ex
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11. Odd Fellows
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13. Tacony Iron
14. S. D. Warren
14. W. G. Wilder
14. F. Glazier & S
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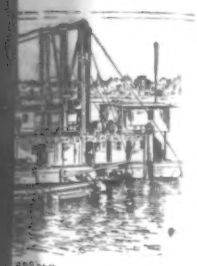

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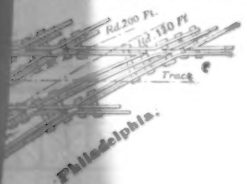

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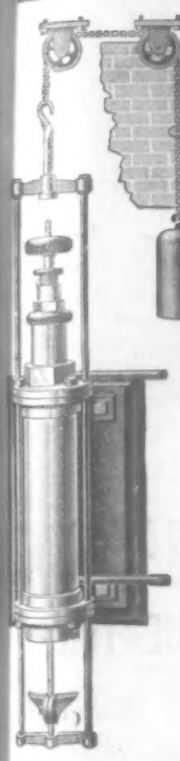

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It is a MARVEL OF ACCURACY, and is especially adapted to VERY HIGH PRESSURES; e. g., where compound steam engines are used for generating electricity, etc.

We GUARANTEE this DAMPER REGULATOR to operate on a variation well WITHIN ONE POUND in THE BOILER PRESSURE. MANY HUNDREDS have been put in operation during the past six years in the

LARGEST STEAM PLANTS

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STEAM, COAL AND MONEY.

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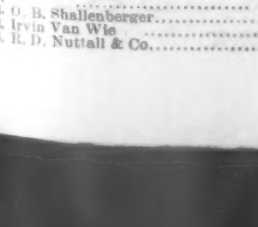

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Five Hundred and Fifty Fire-Proofs in Use.

Fire within a Safe like that on the Express Car. Jointless, one-fourth inch thick, Flexible Steel, that may be beat, buckled, but never broken.

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Northern Pacific has 117; Phil. & Reading, 70; Minneapolis, St. Paul & Sault Ste. Marie, 43; Can. Pacific, 48; Great Northern, 15.

DAILY SALES OF WESTINGHOUSE ENGINES

DURING THE MONTH OF OCTOBER, 1892.

Date				H. P.
1.	Philadelphia & Reading Terminal R. R.	12th order,	Philadelphia, Pa.	85-Comp.
1.	" " "	13th "	" "	85 "
1.	" " "	14th "	" "	85 "
1.	" " "	15th "	" "	85 "
1.	" " "	16th "	" "	85 "
1.	Pittsburg *Chronicle Telegraph*	3d "	Pittsburgh, Pa	60-Stan.
3.	West Michican Furniture Co		Holland, Mich	25-Jun.
3.	H. Mueller Plumbing Co		Decatur, Ill	35 "
4.	F. J. Parson's & Co		Nineveh Junc., N. Y.	15 "
4.	Cochrane Chemical Co	3d "	Boston, Mass	35-Stan.
5.	Cresent Steel Co	6th "	Pittsburgh, Pa	75-Jun.
5.	Pennsylvania Tube Works		" "	75 "
5.	Dawson Electric Light and Power Co	1st "	Dawson, Pa	75 "
5.	" " "	2d "	" "	75 "
5.	" " "	3d "	" "	35 "
5.	Nicaragua Engineering Co		Managua, Nic	10 "
5.	Adam Blumer		Monroe, Wis	25-Stan.
5.	Bridgeport Copper Co (kodak)	6th	Bridgeport, Conn	100-Comp.
7.	Westinghouse El. & Mfg. Co	35th "	Pittsburgh, Pa	330 "
7.	" " "	36th "	" "	130 "
7.	Wm. Clark Thread Co		Westerly, R. I	10 Stan.
7.	United Gas Imp. Co	25th "	Philadelphia, Pa	75 "
7.	H. J. Russell		Tekon, Wash	50 Jun.
7.	Evanston El. H. Co	5th "	Evanston, Ill	100 Comp.
7.	J. E. Reinecker		Chemnitz, Ger	85 "
7.	Yuan Boyer		Ygualade, Spain	45 "
7.	Ygs. Y. Bertran		San Felice	65 "
7.	Jose Solderila Casas		Balsareny	85 "
7.	Josa Tobra		Castellar	200 "
8.	Bourke, Stroub & Co		Knoxville, Tenn	35 Jun.
10.	Pittsbugh Reduction Co	5th "	Kensington, Pa	330 Comp.
10.	" " "	6th "	" "	330 "
10.	Detroit Citizens' Street Railway Co		Detroit, Mich	260 "
11.	Montgomery Street Railway		Montgomery, Ala	130 "
11.	Columbian Exposition	5th "	Chicago, Ill	130 "
11.	" " "	6th "	" "	130 "
11.	Odd Fellows Hall	1st "	Philadelphia, Pa	85 "
11.	" " "	2d "	" "	85 "
11.	" " "	3d "	" "	85 "
11.	First National Bank Building	1st "	Pittsburgh, Pa	45-Stan.
11.	" " "	2d "	" "	45 "
13.	Tacony Iron and Metal Co	1st "	Tacony, Pa	25 "
14.	S. D. Warren & Co	26th "	Yarmouthville, Me	80-Comp.
14.	W. G. Wildermauth		Pomeroy, O	5 Jun.
14.	F. Glazier & Son	2d "	So. Glastonb'ry, Conn	25 "
15.	Union Hardware Co		Torrington, Conn	100-Comp.
17.	Johnstown Pass. Railway Co., (kodak.)		Johnstown, Pa	330 "
17.	Rust & Mason	2d "	Forest Mills, Minn	65 "
17.	Shaw Stocking Co		Lowell, Mass	10-Jun.
17.	Kalamazoo Paper Co	2d "	Kalamazoo, Mich	75 "
17.	Unknown		Moscow, Russia	35 "
17.	"		" "	25 "
17.	"		" "	15 "
17.	Unknown		Moscow, Russia	35 Stan.
17.	"		" "	25 "
17.	"		" "	15 "
18.	O. B. Shallenberger		Rochester, Pa	15 "
18.	Irvin Van Wie	9th order,	Syracuse, N. Y	15 "
18.	R. D. Nuttall & Co	2d "	Allegheny, Pa	15-Jun.

Date				H. P.
20.	Fontaine Crossing Co	8th order,	Detroit, Mich	5-Jun.
20.	Roberto Law	4th "	Monterey, Mexico	5-Stan.
22.	Standard Oil Co	3d "	Bayonne, N. J	35 "
22.	Hoyle, Harrison & Kaye		Philadelphia, Pa	35 "
22.	Alexander McLaren		Osceola, Ont	50-Jun.
24.	E. B. Hilman & Co		Kahoka, Mo	50 "
25.	Spreckels Sugar Refinery	64th "	Philadelphia, Pa	75-Stan.
25.	" "	65th "	" "	100 "
25.	" "	66th "	" "	100 "
25.	" "	67th "	" "	100 "
25.	" "	68th "	" "	100 "
25.	Otis Falls Pulp Co	2d "	Otis Falls, Me	5 "
25.	Charleston Gas and Electric Light Co	2d "	Charleston, W. Va	330-Comp.
25.	Robert Mitchell Furniture Co		Cincinnati, Ohio	50-Jun.
26.	Long & Marvin		Glenville, Minn	35 "
28.	William Knight		Chicago, Ill	35-Stan.
26.	Tacony Iron and Metal Co	2d "	Tacony, Pa	10 "
26.	Justice, Bateman & Co	2d "	Philadelphia, Pa	15 "
27.	Moore, Arms & Thompson		Bellows Falls, Vt	75 "
28.	Balt. Elect. Refin. Co	5th (kodak)	Baltimore, Md	100-Comp.
29.	Balt. Traction Co	(kodak.)	" "	200 "
29.	Penoles Mining Co		Mapimi, Mex	60-Jun.
29.	Ott, Mergenthaler & Co		Baltimore, Md	50 "
31.	Globe Furniture Co		Northville, Mich	75 "
31.	Cohannett Mills		Taunton, Mass	5-Stan.
31.	Gaiety Bijou Theatre		Boston, Mass	5 "
31.	Niag. Falls Paper Co		Niagara Falls, N. Y	25 "
31.	Waters-Pierce Oil Co		St. Louis, Mo	50-Jun.
31.	Columbian Exposition	7th order,	Chicago, Ill	330-Comp.
31.	" "	8th "	" "	330 "
31.	Unknown		St. Louis, Mo	50-Jun.
31.	Westinghouse Machine Co	19th "	Pittsburgh, Pa	25 "
31.	Kahn, Lang & Co		Espinall, France	65-Comp.
31.	Monongahela Furnaces	1st "	McKeesport, Pa	5-Stan.
31.	" "	2d "	" "	5 "
31.	Carnegie Steel Co	16th "	Pittsburgh, Pa	5 "
31.	Allegheny Co. Lt. Co	54th "	" "	5 "
31.	" "	55th "	" "	5 "
31.	Otis Falls Pulp Co	3d "	Otis Falls, Me	5 "

SUMMARY.

33 Compound Engines, aggregating	-	5,185	H. P.
35 Standard " "	-	1,180	"
30 Junior "	-	1,160	"
TOTAL, 98 ENGINES, aggregating	-	7,525	H. P.

HENRY D. LAUGHLIN, Prest.
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EFFICIENTLY AND ACCEPTABLY PROTECTS THE PUBLIC FROM ACCIDENT
By an unmistakable warning of the approach of every train, of such vigor and emphasis as to arouse the attention of the most unwary. Gives no false alarms. Obviates employment of watchmen at the majority of crossings, at a great saving in expenditure
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Without one case of breakage in service.
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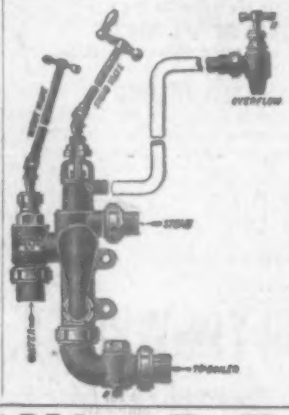
SHEFFIELD VELOCIPEDE CAR COMPANY. Three Rivers, Mich.



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STEAM FIRE EXTINGUISHERS
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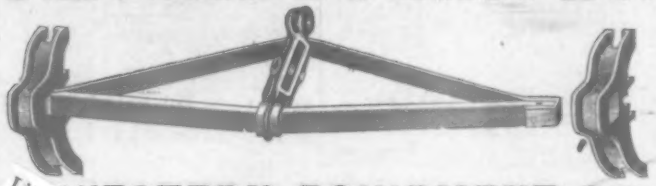
KEWANEE RECTANGULAR BRAKE BEAM.
WEIGHT OF PASSENGER BEAM 75 LBS.
WEIGHT OF FREIGHT BEAM, 60 LBS.
Meets All M. C. B. Requirements.

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MAXIMUM VERTICAL STIFFNESS.
MINIMUM COST OF MAINTENANCE
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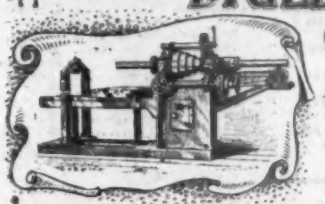
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RAILROAD WORK A SPECIALTY. SEND FOR PRICES.

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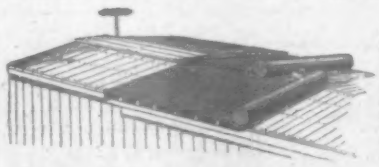
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